The Value Of Blood Counts In Traumatic Gastritis

A. M. MATTESON, D.V.M., E. F. EBERT, D.V.M., and
A. A. CASE, D.V.M., M.S., Columbia, Missouri

ALTHOUGH it is apparent that total white blood cell counts and differential counts can not be relied upon alone for a diagnosis of "hardware disease", analysis of 18 cases of traumatic gastritis, peritonitis, and pleuropericarditis treated at the University of Missouri Veterinary Clinic, reveals periodic, often daily, shifts of total white blood cells from higher to lower counts, or vice versa, plus definite neutrophilic shifts to the left. This, combined with physical findings peculiar to traumatic pericarditis, brings about a more positive approach to the subject of surgical interference.

A review of literature uncovered no previous observation of these periodic changes. It might be assumed that they are brought about by the massing and destruction of the body defenses in their attempt to bring infections under control by circumscribing traumatized areas with fibrous tissue and infiltration with phagocytes. As this fibrous tissue is broken down by muscular activity, such as walking, rumenal function, parturition, et cetera, more phagocytes are poured into the area to check spread of infection, thereby causing corresponding increase in young neutrophils. This increase of juveniles and stabs recedes as infection is checked and repair of tissue has taken place. Since this is not a self-limiting disease entity in more severe cases, this process may repeat itself.

High eosinophil ratios in some of the cases, and normal or near normal ratios in other cases, were interpreted as being the result of stress in varying degree[1].

The majority of these cases presented somewhat similar clinical symptoms, the most noted of which was a rapid drop in milk production, sometimes to the point of complete cessation of milk flow. Other major symptoms were: anorexia, emaciation, atony of the rumen, stiff gait (often causing such severe pain that the animal moved only when forced to do so), grunting on inspiration or expiration or both, soreness of the costosternal region, edema of neck and brisket, heart bruits, and quite often a history of having calved in the preceding four to six weeks.

Traumatic pericarditis has in many instances been mistakenly diagnosed as acetonemia, pneumonia, constipation, non-specific atony of the rumen, impaction, or other disease. Most cases have been diagnosed as digestive disturbances.

Six case histories are presented which show distinct white blood cell changes, as illustrated in accompanying graphs, plus different degrees of severity, recovery, and complication with other disease entities.

Case 1. On May 28, 1952, a five-year-old Hereford cow was referred by a local veterinarian. History included great loss of weight, stiff gait varying in severity, failure to respond to intravenous fluid and oral supportive therapy. Diagnosis was withheld and an unfavorable prognosis given.

The animal was subjected to a thorough physical and laboratory examination. A complete blood count was made daily until rumenotomy was performed, after which blood counts were made as often as thought necessary to check on progress of the infection. Ac-

companying graph depicts daily white blood cell counts.

On May 29, 1 gm. of terramycin and 200 gr. of sodium cacodylate, each in 500 cc. of normal saline, were given intravenously. When observed 12 and 24 hours later, little improvement was noted. On May 30, another complete blood cell count and differential were made and an increase in the white cell count was noted with shift to the left of neutrophilia being constant. A rumenotomy, under paravertebral block was performed*. A sixpenny nail, of which only the head could be felt, was removed from its point of penetration in the anterior ventral wall of the reticulum. Treatment during surgery consisted of 2,000 cc. of 5% dextrose in normal saline intravenously, 3,000,000 units of penicillin intramuscularly, of which, one-half was in oil and one-half in aqueous solution, and 1,000 units of bacitracin ointment applied to the closed incision.

Postsurgical treatment consisted of injecting 3,000,000 units of penicillin in oil intramuscularly for three days and application of hot, wet packs once daily over the operative site for a period of approximately 30 minutes, for five days. On June 6 one-half of the sutures were removed. On June 8 the remaining sutures were removed and the animal discharged. Four months postoperative the animal was reported doing well and was believed to be pregnant*.

Case 2. On May 29, 1952, a two-year-old registered Shorthorn cow was entered at the clinic. The owner reported that he had noticed the cow's condition two days previous. The animal had calved three weeks earlier. Loss of weight, inappetance, stiff gait with arched back, ventral edema of the brisket, and general debilitation were exhibited. Milk flow had ceased. Diagnosis of traumatic gastropericarditis in advanced stage was made and unfavorable prognosis given. It is of interest to note that on auscultation of the thorax distinct splashing sounds could be heard without the aid of a stethoscope.

The cow was given supportive treatment for four days prior to a rumenotomy. Daily treatment consisted of 2,000,000 units of penicillin in oil intramuscularly, and 1 oz. of stimulative tonic *per os.* Also for two days, in addition to the above treatment, 1.25 gm. aureomycin in 500 cc. of normal saline were administered intravenously.

Complete blood counts were made daily with the white cell counts showing daily rise and fall. Shift left of the neutrophilia was constant. On June 2, rumenotomy was performed during which three pieces of baling wire were removed. One piece 3½ in. long was taken from the pericardium and pleura, via the reticulum; the smaller two pieces were embedded in the folds of the reticulum. Treatment during surgery consisted of 3,000 cc. of 5% dextrose in normal saline intravenously and 1,000 units of bacitracin ointment applied to the closed incision. One June 3, 4, and 5. this animal was given 1,500,000 units of penicillin in oil intramuscularly daily, plus 1 oz. of stimulative tonic *per os.* Hot wet packs were applied to the area of incision. On June 6, a fifth rib resection was performed, considerably more than four liters of purulent fluid were drained from the pericardial sac*. The pleura was approximately 2 in. in thickness and the pericardium approximately ½ in. thick. A neoprene tube was sutured with interruped sutures to the pericardium*. Treatment during surgery consisted of continuous intravenous 5% dextrose in normal saline, 500,000 units of polymyxin B sulfate combined with 50,000 units of bacitracin injected into the pericardial sac, and 3,000,000 units of penicillin in oil injected intramuscularly. Postsurgical treatment for the following seven days included daily administration of dextrose in normal saline intravenously, penicillin in oil intramuscularly, and stimulative tonics. The surgical wound was flushed daily with a 1% solution of sodium perborate. On June 14, the same daily treatment was repeated with aureomycin added to the dextrose solution. On June 15 and 16, the pericardial sac was irrigated with a 1:500 dilution of Lugol's solution. Copper sulfate was given orally to control diarrhea which had developed. The animal failed to respond and was destroyed on June 17.

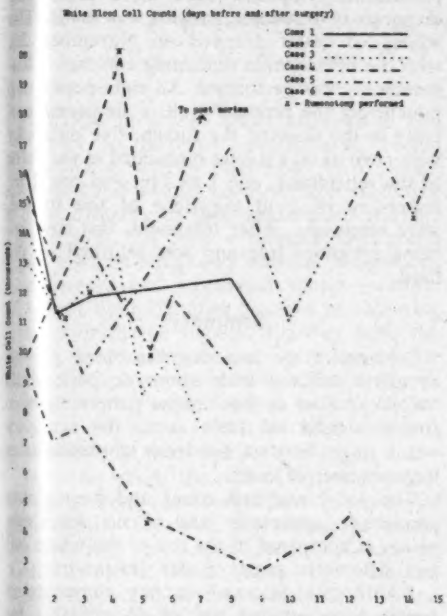
Postmortem examination revealed subcutaneous edema of the ventral surface of the neck, adhesions between the reticulum and the diaphragm, rugae of the abomasum edematous, catarrhal enteritis with marked hyperemia of the small intestine, fatty degeneration of the liver, thickened pericardium which was adhered to the pleura, extensive purulent pericarditis, and the epicardium tightly adhered to the myocardium. Abcesses were present in the left atrium of the heart, and the left lung revealed extensive pneumonia.

Case 3. On June 11, 1952, a three-year-old mixed Jersey and Angus cow was entered at the clinic by a local farmer, who reported a history of stiff gait, hunched attitude when standing, complete and sudden cessation of the milk flow, and great loss of weight. The cow

*Motion pictures of this operation were made for future reference and teaching purposes at the clinic.

had calved five weeks earlier and had become steadily worse since the first heat period.

On physical examination, distinct splashing sounds could be heard on auscultation of the thoracic region; also, there was marked soreness of the costosternal region and atony of the digestive tract. Two successive daily blood counts indicated rise and then fall of the white cell count and a shift to the left. On June 12,



rumenotomy was performed and a crating nail removed from its point of penetration on the ventrolateral wall of the reticulum and diaphragm. Treatment during surgery consisted of giving 5% dextrose in normal saline intravenously. Postsurgical treatment consisted of hot wet packs placed over surgical area, and penicillin in oil intramuscularly daily for three days. Also, the cow was milked twice daily until discharged ten days postoperative. This animal came back into normal milk production in five months.

Case 4. On July 2, 1952, a high producing four-year-old Jersey cow was entered at the clinic. Calving date was noted to be four weeks previous. History revealed symptoms of weight loss, reduction of milk flow, and treatment without noticeable response, after calving a year previous. (Evidence was subsequently found that this was possible in that a small piece of eroded no. 9 wire was removed from deep embedment in the reticular wall.) Daily blood cell counts were made and charted to show periodic rise and fall of the white cell count and shift to the left. Four days after surgery the white cell count dropped to 2,900 and remained in this low range for five days, after which, it returned to near normal. It was at this time that dysentery, probably virus in origin, became a complicating factor, and as will be noted, treatment was altered in an effort to abort this complication. On July 6, rumenotomy was performed. An eight-penny nail and a 1 in. piece of wire were removed from the right ventral wall of the reticulum. Treatment during surgery was as outlined for previous cases reported. The schedule of post surgical treatment was: July 7 and 8, hot wet packs applied to area of incision; July 9, rumen transplant;† July 10, 2,000 cc. of citrated whole blood and 1 gm. of terramycin in 4,000 cc. of 5% dextrose in normal saline by continuous intravenous drip method; July 11 and 12, 2,000 cc. of defibrinated blood and 4,000 cc. of 5% dextrose by continuous intravenous drip method, daily; July 13, 14, 15, and 16, sulfonamides intravenously in therapeutic dosage, and a rumen stimulant consisting of 60 gr. barium chloride, 60 gr. tartar emetic and 0.5 gr. strychnine sulfate *per os.*

On July 17 the white cell count was near normal and the temperature at a near constant 101 F. average. Consequently the cow was turned on pasture and milked twice daily until discharged July 24. By November 17, this cow was in the milking line, having returned to full milk production*.

Case 5. A valuable six-year-old purebred Angus cow was referred to the clinic on September 8, 1952. This case is of special interest because anaplasmosis was the complicating factor. History of this cow included being off feed for a period of approximately three weeks, losing weight rapidly, and unsuccessfully treated by a local veterinarian. The animal was debilitated, weak, and icteric. Tentative diagnosis of anaplasmosis was made.

Blood smears were negative for anaplasma bodies the first ten days, as were blood cultures on tryptose agar. The white cell count was high, with slight shift to the left of the neutrophilia. Nonspecific infection was suspected and treatment with antibiotics was given for four days with little apparent results. Daily fecal samples were of such low parasitic egg count as to make internal parasites insignificant as a causative factor. It is to be noted that the temperature of this animal was never above normal. On September 18, ten days

†Experimental "quick frozen" rumen transplant supplied by H. H. Robertson, Department of Agricultural Chemistry, University of Missouri, Columbia.

after entry, presence of marginal bodies was observed in red blood cells, these observations being confirmed on succeeding blood smear examinations. Sodium cacodylate, 240 gr. in 500 cc. of 5% dextrose, was given intravenously. One oz. of stimulative tonic was given *per os*. For the period September 19 to 28, 1 oz. of tonic and an antihistamine solution were given in attempt to check histamine reaction which might develop, as indicated by high eosinophilia which occurred periodically.

Average Neutrophil Differential

Counts before operation	Myelocytes & juveniles	Stabs	Segmenters	Lymphocytes
1st	9	24	23	27
2nd	11	19	22	30
3rd	7	17	21	35
4th	6	23	18	47

Individual counts showed wide variation in each of these columns, but averages remained near constant. The fourth neutrophil differential in these averages is the average of only two cases, 5 and 6. The counts of case 5 are averaged in only after definite shift to the left was observed.

Potassium iodide, 1 dr. daily, was given as an alterative for the last six days of this period. On September 29, the white cell count was high with little alteration of the differential from that first observed. Sulfonamides plus antibiotic therapy were again instituted in an effort to abort apparent infection. This, plus a repeated dose of sodium cacodylate and stimulants to preserve rumenal activity effected little response. On October 2, a more noticeable shift to the left in the neutrophilia and consequent daily rise and fall of the white cell count were observed and gave cause for a tentative diagnosis of traumatic gastritis as a complicating factor.

Rumenotomy was performed October 9 and a 1 in. wood screw removed from the ventral wall of the rumen. Adhesions to the sternal musculature were evident but were not extensive.

Postsurgical treatment was as previously outlined. On October 16 all sutures were removed and hot wet packs applied to the surgical area. Uneventful recovery followed.

Case 6. On November 18, 1952, a high producing eight-year-old Holstein cow belonging to the Dairy Department of the University of Missouri was examined by the ambulatory clinician. The cow had gone off feed, and there was complete cessation of milk production in two days. This cow was extremely sore in the costosternal region and stood with an arched back attitude, moving only when forced to do so. There was slight to negative rumenal activity, general inappetance, and a temperature of 102.8 F. A blood sample was taken and the manager advised to bring the animal to the clinic. A complete blood count was made with the white cell count being higher than normal and with a noticeable shift to the left of the neutrophilia. On November 19 the white cell count was higher and the shift to the left more prominent, symptoms were more acute and diagnosis of traumatic gastritis was made. The white cell count dropped on November 20, with the neutrophilia remaining constant. Rumenotomy was performed. An eight-penny nail puncturing the reticular wall, a six-penny nail lying in the floor of the rumen, five pieces of wire (two of which were embedded in the folds of the reticulum), one 1 in. bolt and one 1 in. cotter-key lying in the floor of the rumen, were removed. After treatment, this cow became symptom free and was returned to the herd.

Summary

In view of the fact that the blood picture of cattle affected with traumatic pericarditis follows a more or less unique pattern, further studies should be made as to the accuracy which might be obtained from tabulation of a large number of cases.

The red blood cell count and hemoglobin percentage apparently are of no diagnostic value, as compared to the use of the white cell and differential count in this disease entity.

Justification of exploratory rumenotomy comes from prudent use of all available facilities both physical and laboratory. When the operation is performed early and successfully the animal is able to continue in the production line or is again of relative value to the owner. Prompt intervention will result in a high recovery rate and more satisfied clientele. Of the 18 cases reviewed there were two animals in which no penetrating foreign body was found. Three of the 18 animals died at the clinic *in extremis;* at least 12 were restored to productivity.

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Synthetic Media Powder To Enhance Rumen Microfloral Growth And Activity: Preliminary Report

R. W. WESTCOTT, D.V.M., G. R. MOORE, D.V.M., M.S., G. H. CONNER, D.V.M., M.S., Ph.D., and W. F. RILEY, D.V.M., M.S., East Lansing, Michigan

THERE have been many attempts in late years to increase and enhance rumen microfloral activity by direct transfer of rumen contents from healthy cows to those exhibiting clinical evidence of decreased rumen activity. This technic has been a valuable therapeutic adjunct where symptoms indicate indigestion, inappetance, and suppressed rumen motility. However, the difficulties involved in obtaining and administering ingesta, together with the danger of spreading disease, have limited use of the direct transfer method. Clinical experience and observation lead us to believe that dried or dessicated forms of rumen contents are inferior to the fresh material.

In recent years, the role of bacteria, protozoa, enzymes, and breakdown products of their activity has been the subject of extensive research in bovine rumen physiology. Advances have been made by Hungate, Huhtanen, Baker, Bryant, Huffman,[1,2,3,4,5] and others, in studying the perplexing problems presented by the physiology of digestion in ruminants. Information at present is incomplete concerning normal rumen bacterial and protozoan flora, by-products of cellulose, protein, and starch digestion by these organisms, effects on the host and organisms themselves, enzymes of ruminant digestion and their action, and growth and habitat requirements.

Search has been made for a means of utilizing the advantages of rumen transfer in a manner to avoid the disadvantage of the direct inoculation technic. Opinion has been expressed that symptoms of decreased microfloral activity exist because the rumen becomes an undesirable place for these vital organisms to grow and multiply. By further reasoning, if this undesirable condition could be corrected by introducing into the rumen a suitable media on which organisms already present could grow, results might be obtained equalling those reported following transfer of fresh ingesta. After perusal of available literature and innumerable trials, there has been devised, in cooperation with the research staff of Jensen-Salsbery Laboratories, a formula for a synthetic rumen media. This product has been given the designation profloran® and consists of chemical ingredients known to favor bacterial growth in the laboratory.

Materials and Methods

Materials used in production of this formula are for obvious reasons unpublished, and are available only for experimental use. The media, a powder, may be mixed with water and given via stomach tube or may be injected directly into the rumen, or may be placed on the feed. Clinical observations on use of this new formulation in treatment of 139 cows in the clinic at the Michigan State College, East Lansing, during the past year are reported herewith. Cases selected for clinical trial were those which previous experience indicated would have benefited from rumen transfusion. Cases concerned fell into the following broad classifications:

81	following surgery for traumatic gastritis
28	stasis and putrefaction of rumen contents following parturition and/or acetonemia
14	impaction and stasis of forestomachs
9	inhibition of rumen flora and activity by overdosing with molasses, sugars, sulfonamides, etc.
7	complete stasis of rumen resulting from ingestion of placenta
139	total

To assume that each of the above patients benefited because a rumen media product was used would not be consistent with fact. All of these cases, except nine, were subjected to exploratory laparotomy and/or rumenotomy.

In 81 cases of traumatic gastritis following

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removal of nails or wire, it is believed that a better rate of recovery was obtained because of earlier initiation of rumen activity and motility.

Stasis and putrefaction of rumen contents following calving and/or acetonemia is a common entity observed in dairy cattle. Symptoms exhibited by animals used in this trial resembled those observed in patients with traumatic gastritis. In many instances, such cows were referred for surgery by veterinarians in the field. Of the 28 cases falling in this category, six were severely toxic. Surgical removal of putrefied contents, followed by implantation of new rumen contents and the experimental media, failed to produce desired response in these cases and slaughter was advised. The other 22, receiving the same treatment, made uneventful recoveries. Where putrefaction was advanced, rumen contents were removed manually, and in some cases this procedure was followed by flushing. Several pounds of fresh contents from a donor with a permanent rumen fistula, plus the experimental media, were then administered through the surgical opening. In these cases, the media alone could not be expected to effect recovery, and fresh contents were therefore indicated. This does not detract from the value of the media, however.

The 14 cases of complete impaction were handled surgically. Media was introduced after approximately one third of the impacted mass had been removed. It is believed that these cases responded more rapidly than they would have if no media had been used. Certainly they responded more rapidly than cases conventionally treated. The seven cases of impaction due to ingestion of placenta fell into the same class, though these were more toxic. Generally, similar results, *i.e.*, improvement after surgery and use of the media, were noted.

The nine cases overdosed with molasses, etc., were not submitted for surgery, but were given supportive treatment and media. Six of these recovered uneventfully following three doses of profloran at 48-hour intervals. The other three went to autopsy after treatment and in each of these severe liver destruction with complete fatty degeneration had occurred.

A few pounds of the rumen media were supplied on a trial basis to three practicing veterinarians for use on cases of a nature similar to those described. These men have reported favorably on use of this product.

Conclusion

From the foregoing it may seem that emphasis on surgery prior to use of the media limits field use. Most of the reported cases were approaching terminal stages, some after prolonged treatment in the field. Results based on field trials indicate benefit from early use of the experimental rumen media. Cows with mastitis that have been treated for several days with sulfonamides and are presented in depressed toxic states, those with chronic acetonemia, rumen impaction, forage poisoning, diarrhea, and dehydrated conditions represent only a few of the field conditions that should benefit from use of profloran. This product opens up a new field in the treatment of digestive disorders of ruminant animals. Trials to date have been extremely encouraging. Additional clinical tests now being completed are expected to substantiate the findings observed in the cases reported.

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Regional Plan for Veterinary Students in the West

Dr. Floyd Cross, dean, School of Veterinary Medicine, Colorado State College, Fort Collins, reports that a plan of regional training for veterinary students from states not offering such training facilities is now in operation at Colorado. Cooperating states are Oregon, Montana, Arizona, and New Mexico. Wyoming will participate later. Number of students accepted annually from each state cooperating in the plan is limited. Costs are assessed at $1,200. per student per year.

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In retrospect (1952), two deficiencies in our [disease] control procedures stand out with deplorable clarity. First, is the absence of any systematic plan for coping with an emergency, such as is now presented by the appearance and spread of vesicular exanthema throughout the Middle West; and second, is the absence of effective leadership, which the livestock industry has a right to expect from federal and state governments, when disaster strikes.—*R. L. West, D.V.M., St. Paul, Minn.*

A Preliminary Note On The Bacteriology And Experimental Production Of Infectious Atrophic Rhinitis Of Swine

K. A. McKAY, M.A.,* and G. R. CARTER, M.S., D.V.M.,*
Guelph, Ontario, Canada

THE etiology of infectious atrophic rhinitis is not known. Attempts to produce the disease with bacteria-free filtrates of infectious material have been unsuccessful (Gwatkin and Plummer,[1] Schofield and Jones[2]). The work of Switzer[3] and Spindler, Shorb and Hill[4] has not demonstrated conclusively the etiological significance of trichomonads.

Turbinates and ethmoids from pigs affected with rhinitis possess a varied and populous bacterial flora. With a view to eliminating saprophytic bacteria, one of us (K.A.M.) developed a method which makes use of rabbits. This technic has been outlined by Gilman[5]. It involves either the injection of ground infectious material into the subcutis of the rabbit or the insertion of a small section of diseased turbinate into a subcutaneous pocket. Cultural examinations of the rabbit subcutis were made after postinoculation periods of three to five days. If saprophytes were still present, a portion of the subcutis was transferred either by injection or insertion into the subcutis of a second rabbit.

After one or two such passages, the subcutaneous lesions consistently yielded *Pasteurella multocida* on aerobic, 10% CO_2, and anaerobic horse blood agar. Examination of the anaerobic plates by means of a dissecting microscope (X30, X75), revealed numerous L-type colonies (Dienes and Weinberger[6]), and minute, round, discrete colonies. Sections of agar containing the L-type colonies were dropped in Brewer's thioglycollate broth enriched with horse serum. In some of the tubes only the L form propagated, but in others a bacillary phase appeared after periods of incubation varying from three to eight days. In the thioglycollate broth the L growth appeared as lightly turbid, fluffy, floccules in the lower anaerobic portion of the medium. Morphological elements characteristic of the L forms were demonstrated in hanging drops of culture fluid containing a small loopful of Leoffler's methylene blue and in Giemsa-stained smears. Bacilli derived from the L-type colonies were identified, on the basis of morphology, growth characteristics, and pathogenicity, as the Gram-negative nonsporulating bacterium, *Spherophorus necrophorus*. Both kinds of colonies have been observed in large numbers from the turbinates and ethmoids of 71 of 81 pigs affected with atrophic rhinitis. Klieneberger-Nobel[7] has described the two different colonies referred to above as "flat unstructured ones of the well-known *Fusiformis necrophorus* type and the small opaque ones showing a dark granular centre and a more transparent, beautifully structured peripheral part."

Comminuted rabbit subcutis yielding only *P. multocida* and *S. necrophorus* has repeatedly produced rhinitis when instilled by us into noses of young pigs. As a general rule, six series of instillations were administered bilaterally. The first instillations were begun before the pigs had reached two weeks of age. In preparation for the observations made by Gilman, one of us (K.A.M.) produced the typical disease in five of six pigs, employing rabbit transfer material of the fifth, sixth and seventh passage. Protozoans have not been observed in hanging drops of infectious rabbit subcutis. In two trials involving 13 pigs, pure cultures of *P. multocida* failed to produce rhinitis in any of the experimental subjects.

In experiments involving the use of bacterial cultures, consideration should be given to the observations of Morton, Smith and Leberman[8] in connection with symbiotic growth of pleuropneumonia-like organisms (indistinguishable from L forms of bacteria) with bacterial colonies. The authors have observed colonies of *S. necrophorus* growing within a larger colony of *P. multocida* on several occasions. That *S. necrophorus* grows well in association with aerobic organisms has been known for many years.

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*Ontario Veterinary College, Guelph.

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Evaluation Of Di-phenthane-70 In Removing Fringed Tapeworms From Sheep

REX W. ALLEN,* B.S., M.S., and PATRICIA KYLES JACKSON,*
Washington, D. C.

LOSSES arising from condemnation of sheep livers amount to many thousands of dollars annually. The principal cause of such losses in western sheep is the fringed tapeworm, *Thysanosoma actinioides*. This fact has stimulated interest in a means of removing the parasites from sheep by medication, thereby alleviating ill effects that may be produced by the tapeworms as well as reducing liver condemnations at time of slaughter.

Until recently no drug had been shown to have any appreciable effect in removing the fringed tapeworm. In 1949, Ryff, Honess, and Stoddard reported that di-phenthane-70 was effective for this purpose when given as 10-gm. doses in tablet form, or 50 cc. doses in the form of a 20% suspension. Treatment apparently removed all fringed tapeworms from five of seven sheep in controlled experiments. Ryff, Browne, Stoddard, and Honess (1950) conducted further investigations with the drug in question and concluded that 0.25 gm. per lb. body weight for sheep on feed and 0.05 gm. per lb. after 24 hours of starvation were effective against the fringed tapeworm. Small lambs of 30 to 40 lb. required more per pound, 0.4 gm. being considered a practical dosage level for lambs on feed. The same investigators found that, following administration of di-phenthane-70 at the rate of 0.04 gm. per lb. body weight to 3,455 sheep after 12 to 24 hours starvation, liver condemnations were only 5.3% as compared with 16.8% in 1,396 untreated sheep. It was also observed that about the same dosage (0.045 gm. per lb. body weight) reduced liver condemnations to an even more marked extent in sheep that were not starved before drenching. Olsen (1951) observed a 70% reduction in number of livers condemned in 128 sheep given 1 oz. of di-phenthane-70 following a period of fasting, but only a 29.5% reduction in 109 sheep given 2 oz. of the medicament, when compared with equal numbers of controls.

On the other hand, Harshfield (1952) found no reduction in liver condemnations in 73 lambs given 6.5 gm. of di-phenthane-70 as compared with 83 controls.

The present report covers further attempts by the writers to evaluate efficacy of di-phenthane-70 in removing fringed tapeworms from sheep. The work described herein was carried out in cooperation with the New Mexico Agricultural Experiment Station. Professor P. E. Neale of the Animal Husbandry Department of New Mexico College of Agriculture and Mechanical Arts kindly made available experimental animals and data concerning their weights.

Methods

Tests were conducted after sheep had been moved from the range to dry feed lots. All animals of test 1 were yearling wethers. No effort was made before treatment to determine whether the sheep harbored fringed tapeworms, but incidence of 49.5% had been observed the previous year in sheep of the same age and coming from the same ranch. In test 2 all animals were lambs about six months of age, with the exception of one treated and one control, which were yearling wethers. All sheep of test 2 were determined to be infected by fecal examination before treatment.

The di-phenthane-70 used in these tests was a 15% suspension; it was given in the form of a drench. There was no fasting prior to treatment. On a per lb. body weight basis, treated sheep of test 1 received from 0.244 to 0.262 gm. of di-phenthane-70; those of test 2 received from 0.244 to 0.258 gm., with the exception of one sheep which received 0.193 gm.

At the time of slaughter of the sheep, from 4 to 122 days after treatment, tapeworms were removed, counted, and their volume by displacement measured. Numbers of livers condemned were recorded. For the most part, controls were slaughtered at the same time as the treated sheep.

Since the means of transmission of *Thysanosoma actinioides* is not known, and since the

*Zoological Division, BAI, Agricultural Research Administration, USDA, Washington, D. C. Field station, State College, N. M.

majority of the sheep used in these experiments were held in feedlots for several weeks after treatment, question may rightfully be raised concerning the possibility that transmission of the parasite occurred in the feedlots used in this work, and that, therefore, some of the sheep may have acquired tapeworms after treatment. Although no sheep coming from tapeworm-free areas were fed in the same lots with sheep harboring fringed tapeworms at the time the present investigations were carried out, the writers (unpublished data) have in previous years examined a large number of such animals.

During 1949, 1950, and 1951, careful postmortem examinations were made of a total of 75 lambs that had come from supposedly tapeworm-free areas and been confined in feedlots with 154 lambs originating on range where a high incidence of fringed tapeworm occurred. Holding periods (periods of exposure) ranged from 33 to 110 days. Examinations showed that 87 (56.5%) of the 154 range lambs harbored fringed tapeworms, while none of the 75 exposed lambs was infected. Moreover, in the case of the 75 exposed lambs, the contents of the superficial bile ducts and duodena, normal locations of Thysanosoma, were examined microscopically so that any small tapeworms (proof of recent acquisition) would be discovered.

Prior to 1949, some 261 supposedly tapeworm-free lambs were confined in these same lots with 439 range lambs for periods of from 101 to 113 days. At the end of the period of confinement, 247 of the range lambs were found to have Thysanosoma, while three of the 261 exposed lambs also had them. However, in the latter instance possibility that the infections were acquired prior to the time the lambs were placed in feedlots can not be ruled out.

It is evident from the above that acquirement of Thysanosoma in the feedlots in question is an extremely rare occurrence, if it occurs at all. It is our opinion, therefore, that results of the present experiments were not influenced significantly by post-treatment acquirement of tapeworms.

Results and Conclusions

As shown in the accompanying table, results of test 1 seemed to show that the medicament had some effect in removing the tapeworms. As compared with controls, more treated sheep were free from tapeworms at time of slaughter, there were fewer tapeworms in those treated sheep that remained infected after treatment, and the volume of the parasites was less.

TABLE 1. Efficacy of Di-phenthane-70 in Removing Fringed Tapeworms from Sheep

			Postmortem Findings			
			Livers			
		No. of Sheep	In-fected %	Con-demned %	Total no. worms	Total vol. of worms (cc.)
Test 1	Treated	19	31.6	10.2	27	4.8
	Controls	19	52.6	26.0	80	17.1
Test 2	Treated	6	100.0	50.0	38	17.7
	Controls	7	85.7	33.3	65	15.6
TOTALS	Treated	25	48.0	20.0	65	22.5
	Controls	26	61.5	26.9	145	32.7

In test 2, the treatment had little or no effect, despite the fact that dosages were approximately the same as in test 1. As compared with controls, there was no reduction in numbers of sheep harboring tapeworms, and no reduction in volume of the tapeworms. The table shows that there were only 38 tapeworms remaining in the six treated lambs as compared with 65 tapeworms in the seven controls (one treated lamb died within 24 hours after being treated), but analysis of variance, utilizing transformation of data as suggested by Snedecor (1946) for small numbers, showed that this difference was not significant. Also, it should be pointed out that one control lamb apparently lost its infection spontaneously, while another control of this series retained 28 tapeworms, a number well above average for the remainder of the controls. Interestingly, analysis of data for test 1 showed a highly significant difference between numbers of tapeworms remaining in treated sheep as compared with controls, but of the two series of tests, results of test 2 are considered more reliable because all of the sheep were known to be infected before treatment, while in test 1, as stated previously, this was not known.

On the basis of individual weight gains, there was no advantage in treating the sheep; neither was there evidence that the medicament was toxic.

It is evident from the present work, as well as from reports of previous investigators cited herein, that action of di-phenthane-70 against the fringed tapeworm is decidedly erratic. Most favorable reports on the drug have been based on liver condemnations rather than on complete counts of tapeworms remaining after treatment, yet in these reports there is some inconsistency. Thus while Ryff, Browne, Stoddard, and Honess (1950) found evidence with a limited number of test sheep that fasting prior to treatment enhances effectiveness of the drug, thereby decreasing the amount necessary for treatment, their own work with large numbers of sheep showed that liver condemna-

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tions were slightly higher in sheep starved before treatment than they were in sheep not starved but given dosage similar to that given the starved group. Also, Olsen (1951) reported a 70% reduction in liver condemnation following treatment of lambs with one ounce of di-phenthane-70 (calculated by the writers to be 4.5 gm. of active agent) following a period of fasting, but only a 29.5% reduction in lambs given twice that amount, while Harshfield (1952) observed no reduction in lambs given 6.5 gm. of active agent, presumably without preliminary starvation. It is apparent, therefore, that inconsistent results have characterized work with the compound in question regardless of dosage and regardless of prior starvation.

The question of age of experimental animals deserves some comment, particularly since results might be interpreted as showing that medicament is more effective in yearlings than in lambs approximately six months of age. In this respect, it is worthwhile to note that Ryff and coworkers (1950) mention only that small lambs of 30 to 40 lb. require higher dosages than older sheep. Olsen (1951) used feeder lambs, treating them in the spring when, presumably, they were about one year old, while Harshfield (1952), using feeder lambs weighing about 65 lb., treated them in the fall. Thus there is some indication that age of experimental animals may be a factor of importance.

Summary

Viewed as a whole, results obtained in the work here described appear to justify the conclusion that the 15% suspension of di-phenthane-70, as used in these experiments, had little appreciable and consistent effect in removing fringed tapeworms from sheep.

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Antibiotics are drugs, and they cannot be expected to replace vitamins or amino-acids in rations. — *J. D. Nadeau, D.V.M., M.Sc., St. Hyacinthe, Que.*

Foot-and-Mouth Disease in Mexico

Reports assuring appropriate action against foot-and-mouth disease under direction of the Mexico-United States Joint Commission, organized after Mexico was declared free of foot-and-mouth disease on September 1, 1952, appeared in both the July and August issues of VETERINARY MEDICINE. These reports quoted official releases to the effect that a limited outbreak had occurred 375 miles south of the border and that prompt diagnosis was made of infection in four herds, representing approximately 500 to 700 animals. These were to be slaughtered immediately and inspection procedures instituted without delay. Two quarantine lines were established.

Recent reports in daily newspapers and some farm journals indicate that reversals have occurred, that the agency set up for disease control has been by-passed, and that political influence has been exerted to stop further control by condemnation and slaughter. Infection is reported to have jumped quarantine lines and an estimated 7,000 to 9,000 animals are said to be infected in the region. Source of infection in the current outbreak has not been determined. The virus has not been known to exist outside of host animals for longer than one year. It is a fair assumption that infection may be present in the wildlife of the region.

Official word of the situation in Mexico is limited. United States officials there have adhered to a no-vaccine policy based on the premises that vaccination may mask symptoms and, at best, confers slow, inadequate, and short-lived protection.

The most recent official release of the USDA, dated August 4, 1953, states that on the basis of suggestions by Mexican members of the Commission, a program has been agreed upon for the eradication of the current outbreak. This agreement, apparently a compromise, calls for use of most practical methods in "evacuation" of animals, consistent with the need for safety in preventing spread of the disease. When no more susceptible animals remain in the present area of infection disinfection measures will be instituted. After approved measures of disinfection have been carried out, including burning of pastures, susceptible animals will be added to make certain premises are safe.

There are an estimated 10,000 cattle, sheep, swine, and goats involved in the most recent outbreak. The area of infection, near Gutierrez Zamora, State of Vera Cruz, will

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Preliminary Report On Serological Relationships Between Strains Of *Vibrio fetus*

K. E. PRICE,* M.S., L. J. POELMA,* M.S., D.V.M., and JOHN E. FABER, JR.,** Ph.D., College Park, Maryland

IN order to develop a satisfactory serological test for the diagnosis of vibriosis, two basic assumptions must be shown to be true. First, it has been generally assumed that *Vibrio fetus* strains are so closely related serologically that any strain which grows well on laboratory media, and shows a low degree of non-specific reaction when tested against normal bovine sera, will be satisfactory for use as an antigen in the agglutination test. Second, it has been assumed that other Vibrio, morphologically indistinguishable from *V. fetus*, have no serological relationship to the etiological agent of vibrionic abortion.

Smith and Taylor[1] reported in 1919, that 21 of 22 strains of *V. fetus* studied were probably identical, based upon tests with four specific antisera. The remaining strain differed somewhat, but, according to the authors, it belonged to the same group on the basis of its agglutination affinities. This publication undoubtedly is the basis for belief that only insignificant serological variations are found among strains of *V. fetus*.

Blakemore and Gledhill[2] in 1946, studied four strains of *V. fetus* isolated from aborted ovine fetuses. The flagellar portion of the organism apparently held the antigen or antigens responsible for cross reactions obtained, since the somatic portion of the cell seemed to contain strain specific antigens. Subsequent to this work there has been no report in the literature of any further investigations on serological relations of *V. fetus* strains. Principal work since that time has been carried out by Plastridge and his coworkers[3,4,5,6]. These investigators have endeavored to produce a reliable agglutination test for vibriosis. Although they have contributed a great deal toward finding a satisfactory diagnostic procedure, discrepancies have become evident and it is because of these that this study was undertaken.

Materials and Methods

Cultures. Thirty-four strains of Vibrio were used in this study. Eight were obtained from the Live Stock Sanitary Service, College Park, Maryland; 24 from the Bureau of Animal Industry, U. S. Department of Agriculture; one from Dr. W. N. Plastridge; and one from the American Type Culture Collection. Of the 34 strains utilized, 20 were isolated from bovine fetuses, two from ovine fetuses, five from bovine vaginal mucus, one from the bovine uterus, and three from bull semen. A strain isolated from tissues of a hog suffering from dysentery was also included in the study. Two bovine strains were included although no additional history had been obtained regarding source of their isolation.

Strains of Vibrio used in this study were maintained on thioglycollate medium (Brewer modified). Use of this medium in maintaining and isolating strains of *V. fetus* was described by Hansen *et al.*[7] Stock cultures were transferred monthly during the course of this study with no loss.

Preparation of Antigens. Whole cell antigens were prepared by growing the organisms in Kolle flasks containing 3% thioglycollate agar. Flasks were incubated for 96 hours under 5 to 10% CO_2. Organisms were freed from the surface of the medium by sterile swabs after 20 to 30 cc. of formalinized saline had been added to the flask. Suspensions were filtered through a double layer of gauze, washed three times in formalinized saline, and density adjusted spectrophotometrically to approximately 300,000,000 cells/cc. for agglutination tests.

Organisms used in preparation of somatic antigens were cultivated and harvested as above. Physiological saline suspensions of cells were boiled for 30 minutes in order to destroy flagellar antigens. After boiling, flasks were kept tightly stoppered until they were to be used for agglutination tests.

Immunization of Rabbits. Living cell suspensions used in producing rabbit antisera were prepared in the same manner as the whole cell test antigens except that physiological, rather than formalinized saline was used. Immunization procedure was similar to that

*Live Stock Sanitary Service, University of Maryland, College Park.
**Department of Bacteriology, University of Maryland, College Park.

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employed by Warner *et al.*[8] in preparation of rabbit antisera against the non-pathogenic Neisseria group.

All rabbits were heart bled prior to the first inoculation to determine whether any "normal" *V. fetus* agglutinins were present. Rabbits were injected by the ear-vein route with increasing doses over a two-week period. The first day 0.5 cc. of a suspension equal in density to a no. 3 McFarland nephelometer standard was injected. On the next day, 1 cc. of this same suspension was injected, followed by 1.5 cc. on the third day. After a lapse of four days, concentration of the suspension was increased to a no. 4 McFarland nephelometer standard and doses of 0.5, 1.0, 1.5 and 2.0 cc. were given on successive days. Six to seven days after the last injection, 40 cc. of blood were obtained by heart-bleeding. Blood remained at room temperature for several hours and was then placed in the refrigerator overnight. Serum was then collected and preserved by freezing at —50 C. Repeated thawings and refreezings have failed to show any significant drop in the titer of these antisera.

Antisera against the somatic portion of the cells were also prepared by the method outlined. Cell suspensions in this case, however, were boiled two hours to destroy antigenic activity of the flagella.

Agglutination Procedure. Serial two-fold dilutions of serum (1:2.5 through 1:320 with additional dilutions of 1:240 and 1:480) were used. One tenth cc. of each of these dilutions was pipetted into tubes and 2 cc. of antigen added, giving final dilutions of 1:50 through 1:6,400, and additional final dilutions of 1:4,800 and 1:9,600. The mixtures were shaken and placed in a 37 C. air incubator for 48 hours. Whenever a group of sera was tested against an antigen, saline and normal rabbit serum controls were included.

Degree of agglutination was determined by the amount of clearing and quantity of agglutinated cells in the bottom of the tube.

Results

Table 1 shows the results when 34 antigens were tested against 25 antisera. Numbers designate titer, which is the reciprocal of the dilu-

TABLE 1. Agglutination Reactions of 34 Strains of V... Prep...

Group (Strains)	Antigens	2216	PR	5748	7137	6359	175	68	2026	11	7450	...
I. Bovine Fetal	2216	96†	48	32	32	32	48	8	32	4	64	
	PR	8	96	16	96	96	8	8	0	16	96	
	5748	16	16	96	8	8	16	8	48	16	32	
	7137	16	96	32	64	48	8	8	0	32	96	
	6359	48	96	48	64	96	8	64	0	48	64	
	175	96	64	64	32	64	96	32	64	32	96	
	68	48	32	16	8	16	48	64	2	64	16	
	2026	64	32	48	16	48	48	16	96	8	96	
	11	48	48	64	48	64	48	32	48	96	64	
	7450	16	16	16	16	32	16	8	8	64	96	
	7462	16	16	48	8	16	8	8	48	16	48	
	R2	32	48	16	8	32	32	8	64	16	48	
	2029	16	16	8	8	16	32	16	16	32	8	
	15109	32	16	48	16	16	32	32	8	32	16	
	K5	48	32	96	16	64	64	32	32	32	48	
	1875	8	32	16	8	16	16	16	32	48	16	
	D71	8	96	32	16	32	32	16	32	16	8	
	1951	64	64	64	32	96	64	32	96	48	96	
	8356	96	96	48	48	64	64	32	96	64	64	
	1639	32	16	8	8	4	16	16	4	32	16	
II. Ovine Fetal	543	8	32	32	32	48	16	8	4	96	32	
	Ore. 1	32	32	16	16	32	16	8	32	4	64	
III. Bovine Vaginal Mucous	Melody	8	96	48	96	96	4	32	2	32	64	
	19	48	96	32	32	64	48	32	48	96	96	
	35	16	48	48	16	48	2	8	1	96	32	
	D L Dusty	32	64	64	32	48	32	16	32	48	96	
	D L Fashion	0	0	0	0	0	0	0	0	0	0	
IV. Bull Semen	23	48	32	16	8	32	48	16	32	16	64	
	49	48	64	48	16	64	32	32	32	64	96	
	20	0	0	0	0	0	0	0	0	0	0	
V. Bovine Uterus	8	0	0	0	0	0	0	0	0	0	0	
VI. Porcine	7298	0	0	0	0	0	0	0	0	0	0	
VII. Bovine	10311	16	96	48	96	96*	8	8	1	48	96	
	2315	4	64	32	0	32	8	8	96	4	32	

†All numbers equal titer times 10^{-2}.
*Titer determined from highest dilution giving +++ reaction.

tion of the last tube giving a ++++ reaction. Titers of less than 1:100 were considered insignificant.

With some antigens (7,137, K-5, and Melody) complete agglutination was not obtained in any dilution of some sera, although partial agglutination could be observed even in dilutions as high as 1:6,400. Repeated testings invariably gave similar results. An asterisk has been used in table 1 to indicate where this type reaction took place. In these instances, the titer is the highest dilution in which a +++ reaction was observed.

All strains utilized to prepare antisera induced good antibody response in rabbits. Every antigen tested against its homologous antiserum produced a titer of at least 1:6,400. Response of these antigens to heterologous antisera varied from no titer to titers as high as, or occasionally higher than, those obtained with homologous antisera. Source of the strain seemed to play no part in the antibody response of the rabbit.

Most of the 20 bovine fetal strains were found to be closely related (group I). However, it should be observed that while some of these antigens gave good cross-agglutination with all antisera prepared from strains isolated from bovine fetuses, others failed to agglutinate in from one to as many as six of these antisera.

Even among strains that were agglutinated in all bovine fetal antisera there were variations in titers. Strains 11 and 175 agglutinated to a high titer with all antisera, while others such as 7,462 and 1,875 gave only low titers with many of the antisera.

In group II, results obtained with two strains isolated from ovine fetuses are shown. It is obvious that these two strains are closely related to bovine fetal strains.

Of the five strains isolated from the vaginal mucus of cows (group III), four were apparently closely related to strains in group I, while the fifth strain (D. L. Fashion) was unrelated to all strains tested. A titer of 1:9,600 was obtained with its homologous antiserum.

In group IV, two of the strains which were isolated from bull semen (23 and 49) were closely related to group I, while strain 20 failed

olated from Various Sources when Tested Against 25 tisera.

2029	15109	K5	1875	D71	1951	8356	1639	Melody	543	D L Fashion	7298	2315	Normal
2	8	96	0	4	16	48	16	16	4	0	0	8	0
1	0	0	0	1	4	1	0	96	0	0	0	96	0
4	16	32	0	2	8	16	4	64	8	0	0	32	0
0	16	64	0	0	0	48	8	96	8	0	0	64*	0
1	4	8	0	0	4	16	4	96	16	0	0	96	0
16	32	48	4	32	64	64	96	96	16	0	0	32	0
8	48	16	8	8	16	16	64	96	16	0	0	8	0
32	32	64	8	64	96	64	48	16	8	0	0	48	0
16	32	64	16	48	96	96	96	64	48	0	0	32	0
8	32	16	2	8	32	16	48	48	32	0	0	16	0
2	4	32	1	2	32	32	16	16	8	0	0	16	0
48	16	16	48	64	64	16	16	48	16	0	0	32	0
96	64	2	64	64	64	4	64	64	32	0	0	8	0
32	96	16	16	16	16	8	64	64	32	0	0	8	0
8	16	64	8*	8	16	32	32	48	16	0	0	16	0
48	4	64	64	64	64	2	48	48	16	0	1	16	0
16	8	4	16	64	96	16	64	48	32	0	0	8	0
64	32	64	64	32	96	48	48	64	16	0	1	64	0
8	32	96	1	8	48	64	32	64	8	0	0	32	0
4	32	8	0	2	8	8	96	8	16	0	0	8	0
48	16	48	32	32	16	48	64	64	96	1	0	2	0
4	8	32	1	4	32	32	32	16	4	0	0	32	0
16*	16	32	16*	16*	8*	8	4	96	4	0	0	96	0
8	32	64	8	8	32	96	96	32	32	0	0	48	0
2	16	32	4	2	16	64	16	64	64	0	0	8	0
4	16	48	0	8	8	48	48	48	64	0	0	32	0
0	0	0	0	0	0	0	0	0	0	96	0	0	0
16	16	16	4	8	32	16	16	32	8	0	0	16	0
4	32	64	2	8	32	64	96	96	48	0	0	32	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	64	0	0
0	8	16	0	0	2	8	0	96	8	0	0	96	0
8	48	1	32	8	96	1	0	0	4	0	0	96	0

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to agglutinate in any of the antisera tested.

Group V contains only strain eight, which was isolated from the uterus of a cow. It failed to cross-agglutinate with any of the antisera.

Group VI also contains only one strain (7,298). This was isolated from the tissues of a hog that suffered from severe dysentery. As would be expected, it failed to produce cross reactions with any of the antisera. A titer of 1:6,400 was obtained with its homologous antiserum.

Group VII contains two strains of bovine origin. No information was available as to the tissues from which they were isolated. These two strains (2,315 and 10,311) were related to group I; strain 10,311 was obtained from the ATCC.

None of the antigens tested gave any agglutination in saline or normal rabbit serum controls.

All antigen-antiserum combinations that failed to agglutinate, or agglutinated to low titer when tested, were repeated.

Eight somatic antigens (boiled 30 minutes) have been tested in 16 somatic antisera prepared with cells boiled two hours to destroy antigenic properties of the flagella. Maximum titer shown by any of the somatic antisera was 1:800, however the majority of titers ranged from 1:200, to 1:400. Five of the eight strains tested were agglutinated by most of the somatic antisera. Because of the limited nature of the work, no tabulated data will be presented at this time.

Discussion

Strain differences shown in table 1 in no way indicate that there are far reaching differences in antigenic structure of *Vibrio fetus* strains. Certainly, differences between strains were not sufficiently clear-cut to permit separation into groups. Many variations would appear to be of a quantitative rather than a qualitative nature. Thirty of the 34 strains gave sufficient cross-agglutination to be considered closely related. However, since only 21 of the 30 related strains gave cross-agglutination with all antisera tested, it is imperative that a very large number of positive bovine or rabbit antisera be used in selecting a suitable antigen.

Of particular interest were results obtained with strain P-R (Plastridge R). This strain is one that our own laboratory, in common with many others, uses as a diagnostic antigen in the agglutination test. It failed to be agglutinated by six of the antisera prepared from related strains. This may explain in part many of the discrepancies reported in the *V. fetus* agglutination test.

In nine of the 21 antigens that reacted with all antisera from the related strains, titers of 1:200 or less were obtained with some of the antisera. Since titers found in rabbit sera are so much higher than those that are generally found in bovine sera, it is extremely doubtful that enough cross reaction could be obtained with these antigens to demonstrate presence of *V. fetus* agglutinins in the bovine sera. Reactions of antigens, such as Melody and K-5, must also be taken into consideration. Here are instances where antigens give only partial agglutination with some of the antisera. When these two strains were eliminated, the number of potential diagnostic antigens was reduced to ten, or one-third of the total number of related strains. These, of course, would have to be tested against a large number of normal bovine sera in order to determine their nonspecific activities. We intend to test these ten antigens and to select the ones which give consistently low nonspecific reactions for use as antigens.

Results in table 1 clearly indicate that care must be taken in assuming that all Vibrio isolated from the bovine genital tract are *V. fetus*. Three of the ten bovine strains isolated from sources other than tissues or stomach content of aborted fetuses show no serological evidence of any relation to fetal strains. From these results, it appears that these organisms, which are probably saphrophytic species, would be unlikely to cause confusing results in routine agglutination tests.

Only a limited amount of data has been collected concerning relationships of the somatic portion of the cells. Although five of the eight somatic antigens tested appear to be related to about the same degree as the whole-cell antigens, there is a possibility that some may not have been heated sufficiently to completely destroy antigenic activity of the flagella. Because of this possibility, we have no desire at this time to suggest that most strains have somatic antigens in common.

We intend to continue this work on somatic antigens of *V. fetus*, although it may have no direct bearing on practical diagnostic procedure. There has been so little work done on this particular phase of serology, that we feel there is a definite need to continue along this line. One of the most important phases of this work will be to utilize reciprocal absorption tests in an effort to show more clearly the antigenic pattern of *V. fetus* antigens.

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Studies On Modified Hog Cholera Vaccine: Duration Of Immunity

R. C. PERCIVAL,* V.M.D., M. J. HARVEY,* D.V.M., T. JAMES,* and H. KOPROWSKI,* M.D., Pearl River, New York

THE virus of hog cholera was adapted to rabbits[1] and modified[2] by 250 serial rabbit passages to a point where the virus had lost its pathogenicity but still retained antigenic properties for swine. A trial to determine duration of immunity was started January 28, 1951, using this modified live virus as the immunizing agent.

Materials and Methods

Vaccine. A rabbit-adapted, vacuum-dried, modified live virus vaccine[1,2,3] was used throughout the experiments for vaccination purposes**.

Challenge virus. A virulent strain of hog cholera virus was used for challenge purposes. This blood was adjusted to contain 10,000 to 100,000 m.l.d. per cc., and was stored in a dry ice chest at —50 C.

Animals. Sixty-five Yorkshire pigs, approximately three months of age, were imported from the Province of Quebec, a hog-cholera-free area. In addition, 16 normal, susceptible, local pigs were obtained, to be used as challenge controls in the first experiment. These 81 pigs were immediately isolated for 15 days, during which time they remained normal and were considered to be disease free. They were moved from the original isolated area and taken to a farm where pigs had not been kept previously. Caretakers of these test animals were instructed to avoid all contact with other pigs during the entire period of the trial.

Vaccination procedure. Fifty of the 65 Yorkshire pigs, weighing 45 to 60 lb., were inoculated in the medial aspect of the ham with 2 cc. of a commercial lot of modified live virus vaccine; the remaining 15 were left unvaccinated to be used as pen contact controls.

Experiments

On May 20, 1951, four months after the original inoculation of vaccine, four of the 50 vaccinated pigs were challenged subcutaneously with 1 cc. of challenge virus. Sixteen domestic pigs were similarly inoculated as challenge controls. All pigs were observed for at least 14 days postchallenge. All four of the vaccinated pigs survived challenge, whereas all 16 challenge controls developed symptoms associated with hog cholera. The challenge controls either succumbed to the disease or were sacrificed; autopsy revealed lesions indicative of hog cholera in all animals.

Unvaccinated Yorkshire pigs were used as challenge controls in all subsequent work.

TABLE 1. Duration of Immunity Following Vaccination with 2 cc. Modified Live Virus Vaccine

Interval between vaccination and challenge	Date Vaccinated	Challenge virus Date Challenged	Challenge virus (I.M.) 10,000-100,000 m.l.d./cc.	Mortality Ratio deaths/total
4 mos.	1/28/51	5/29/51	1 cc.	0/4
	Controls	5/29/51	1 cc.	16/16
6 mos.	1/28/51	7/30/51	1 cc.	1*/12
	Controls	7/30/51	1 cc.	6/6
1 yr.	1/28/51	2/1/52	1 cc.	0/12
	Controls	2/1/52	1 cc.	4/4
2 yrs.	1/28/51	2/12/53	2 cc.	0/22
	Controls	2/12/53	2 cc.	5/5

*Not hog cholera; anaerobic bacterial infection following trauma.

Six months after vaccination, 12 vaccinated pigs and six unvaccinated controls were challenged in the manner described above. Again all controls succumbed to challenge, while, of the vaccinated animals, all survived with the exception of one which died of an anaerobic bacterial infection resulting from a traumatic wound. Autopsy of this animal revealed no lesions associated with hog cholera.

One year postvaccination, 12 more of the vaccinated pigs and four controls were similarly challenged. As in the previous experiments, all vaccinated pigs survived and all unvaccinated controls succumbed.

On January 29, 1953, two years following vaccination, the remaining 22 vaccinees and

(Continued on page 366)

*Lederle Laboratories Division, American Cyanamid Company, Pearl River, N. Y.

**Hog cholera modified virus vaccine, rabbit origin (vacuum dried), Rovac®, Lederle Laboratories, Pearl River, N. Y.

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Veterinary Progress In Food Hygiene

JAMES LIEBERMAN,* D.V.M., M.P.H., Washington, D. C.

THE veterinarian, over the years, has contributed a great deal to man's welfare by assuring him a safe and wholesome food supply. We in the professions are sometimes prone to look askew at our forebears who helped lay the ground work for our productive growth. It has been said many times that man's survival depended upon proving his superiority over the hordes of animals which preceded him by several millions of years. The more tractable of the wild species which inhabited the earth, he tamed. Through the science of zootechnics, he bred and developed them until they became indispensable to him. Before long, the maintenance of their health and the improvement of their environment became two of his routine obligations. It is perhaps academic, if not utilitarian, to set the birth of veterinary medicine 4,000,000 years ago. Considering this aspect alone, veterinary medicine probably preceded human medicine, since foods of animal origin have always been a primitive requirement. Again, it has been said that veterinary medicine sustains life, while human medicine preserves it.

Thirty-five centuries have passed since Moses, in the 15th century, B. C., proclaimed his doctrines on the eating of clean and unclean flesh. It was indeed long ago that the potential transmission of animal diseases to man was first recognized. Today's antemortem inspection of animals prior to slaughter was clearly defined by Moses, who said, "Animals brought to the tabernacle must be without blemish[1]." His postmortem inspection dictums specified that certain internal organs of animals were to be burned. Particular reference was made to the necessity for slaughterers to keep their hands and clothing clean. Most of us agree that the animals listed by Moses as clean and unclean are those a public health specialist would so list today. Admittedly, swine and shellfish, under adverse conditions of husbandry, frequently are not wholesome. The insanitary hog lot promotes parasitic infections, erysipelas, and suipestifer infections, among other notorious enemies of man and beast. Oyster beds contaminated with human excrement threaten man with typhoid fever.

Proof of antiquity in the field of food control is not lacking. From A.D. 130 to 201, Galen, the philosopher and physician, insisted that food animals be inspected for health. He was supported in his views by Vegetius (A.D. 450-500), sometimes called the Father of Veterinary Medicine. Today, the veterinarian stands high on the list of those who have helped to make the food supply in the United States the safest in the world.

It has been estimated that by 1960 the world will have to accommodate a 25% increase in population. Production of principal foods, in connection with this increase, will demand the resourcefulness of the food-producing countries. Meat production, for example, will have to be increased 46%, while the output of milk and milk products will have to be increased 100%. Alarmed by the present day dilemma, Sir John Boyd Orr, former director general of the Food and Agriculture Organization of the United Nations, stated: "It is not the atomic bomb, but the food crisis, that may destroy us[2]."

At the Animal Diseases Meeting sponsored by that organization in Warsaw, Poland, in 1948, the continued threat of epizootics to Europe's livestock population was discussed. Tremendous losses in milk, meat, and draft power were the main topics of the day. In one country, 150,000 pigs had died in one year from Teschen's disease, a malady which has thus far been confined to Europe. Mastitis was responsible for the loss of 5,000,000 metric tons of milk — enough to give over 30,000,000 infants a pint of milk a day. One of the most significant statements of that conference, describing the problem of brucellosis in Norway, emphasized that the entire eradication campaign in that country had cost less than the annual loss caused by the disease. The cost of prevention is not always as high as it appears. Control procedures should prove to be a boon, not a burden, to those affected.

Assuring Health-Giving Foods of Animal Origin

Control of foods of animal origin is not simple. The practitioner of veterinary medicine makes the final product possible. He guards the health of the herd and, through his

*Consultant, Poultry Inspection and Sanitation, U. S. Public Health Service, and Secretary-Treasurer, Conference of Public Health Veterinarians.

broader knowledge of husbandry, guides the livestock owner along the path toward economic success and increased profit. Threat of an impending epizootic demands the skills of a person qualified to control disease by preventing its spread. That is one type of control. In logical succession, the food-producing animal moves on to supply man with needed nourishment, in the form of protein substance. The condition of these foods when they reach the table is of major concern to every consumer. Methods employed for maintaining adequate supervision over these foods vary in their formulae, and are sometimes rather complex in their application and effect.

Generally speaking, control of food and food products is carried on at three levels of government—each with a particular objective and each entitled to a certain degree of autonomy. It would not be logical for the federal government, for example, to concern itself with the acceptability of a milk supply for the people of Jonesville. Aside from the obvious breach in accepted governmental practice, Jonesville's milk supply can best be supervised by the health officials of that municipality. In like manner, should the state in which Jonesville is located decide to undertake an extensive statewide campaign for the sanitary control of slaughtering operations, the city of Jonesville could help that effort only within its legal boundaries. Hence, it is recognized that there are activities which can not profitably be executed on the local level. Similarly, the federal government is best equipped to follow through on tasks affecting the nation as a whole. Interstate movement of foods and foreign quarantine can be cited as examples of that facet of governmental control.

Public health veterinarians, today, may be found occupying various official positions in city, county, or state health jurisdictions. Some supervise meat and milk inspection; others concentrate on the control of rabies or the supervision of laboratory procedures. In several instances veterinarians are in charge of municipal environmental-health services. In some communities, veterinarians are the health officers.

Municipal and County Problems

The problems of a veterinary nature facing these political subdivisions are quite diverse. It is not always feasible for a municipal or county health department to maintain separate sections for control of milk, meat, rabies, etc., nor is it administratively sound. One good-sized midwestern city has solved administrative problems by setting up a Division of Veterinary Public Health Services within the organizational framework of its health department. The director of such a division must be a veterinarian who is well-versed in the art and science of veterinary preventive medicine, and who has received the benefits of formal training in public health. He should direct a competent staff of veterinarians and specialized environmental hygienists who should be responsible for conducting the mechanics of food control and the attendant problems of sanitation. He should concern himself directly with the transmission of animal diseases to man through foods. He should recognize that for successful accomplishment in the field of epidemiology a close working relationship between the physician and the veterinarian is essential. He should be vitally interested in seeing that the products which are so carefully inspected under the aegis of his division reach the consumer in a safe and wholesome condition. The concept of "follow through" from start to finish is basic to the success of this type of program. (Milk, for example, which has been carefully processed on the farm and in the plant can cause serious disease if served to the consumer in an unclean glass.) The safeguarding of a community food supply from contamination is one of the primary functions of a modern health unit. It should certainly demand alertness on the part of the public health veterinarian.

State Services

In recent years, many forward-thinking states have established veterinary public health programs within their state health departments. Some have seen fit to place such a program administratively in the division of communicable or preventable diseases. In one case, the state public health veterinarian is assistant director of such a division. In this position, he is able to offer consultative service to milk and food control throughout the state, to render professional advice in specific problems involving the hazards of animal disease, and, in addition, to cooperate with private physicians and veterinarians on problems of mutual concern. In another state, a veterinarian heads a Bureau of Veterinary Public Health in a Division of Environmental Health.

Prerequisites for a successful program are twofold: (1) an energetic and dynamic director who enjoys the confidence and support of his department, and (2) an enlightened public. This latter consideration transcends others of seemingly greater importance, and can be developed only by the former.

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Observations to date reveal that, of the many activities covered by state programs, the one needing a high degree of vision and effectiveness is the control of foods of animal origin. It must not be forgotten that the newer term, "veterinary public health", encompasses not only the more romanticized phases of the control of animal diseases transmissible to man directly or through insect vectors; it includes, also, the traditional functions of veterinary services, namely, milk and meat control and animal-products inspection. Insofar as these activities are concerned, the public health veterinarian is indispensable and should be utilized to full advantage. In part, this depends upon our profession's ability to face a number of administrative problems squarely.

A number of municipal government job specifications, covering the duties of and salaries offered to public health veterinarians, were reviewed lately. Description of the duties reveals, in many cases, complete lack of understanding of the contribution the veterinarian can make to the community health program. For the most part, the compensation often is woefully inadequate and would discourage the most high-minded prospective public servant from offering his services. It appears that the profession has much to do in the field of public information. Such a program should be aimed not only at the public, but at the city fathers as well.

In the March 24, 1912, issue of the Houston (Texas) *Daily Post,* Dr. A. T. Kinsley reported to the people of Houston on The Veterinarian as a Public Health Officer. Doctor Kinsley, an outstanding figure in the progress and development of veterinary science, emphasized the importance of veterinary service in control of animal diseases which constitute a human health hazard. Reference was made to inspection of meat-producing animals, meat, and meat products conducted by veterinarians of the U. S. Bureau of Animal Industry.

He accorded the local veterinary practitioner an important place in preservation of human health, because of his constant attention to control of animal-disease plagues in his territory which might be transmitted to man. Tribute was paid to those who acted as municipal meat and dairy inspectors, thus protecting their constituents from exposure to disease through the consumption of unwholesome and infected food products. He stressed that "the highest degree of disease prevention can come from the efforts of the veterinarian and the physician cooperating in the common interest." Particular reference was made to the patient who was suffering from a milk- or meat-borne disease.

There is every reason to believe that concerted action by the veterinary profession will do much to solidify the position of the veterinarian in public health organization.

Federal Programs

It would be a glaring error if the tremendous contributions to food control that have been made by veterinarians of the federal departments were omitted in a discussion such as this. From a humble beginning in 1884, the Bureau of Animal Industry of the Department of Agriculture has established a program which can boast and merit the confidence of the American people. Through its animal-disease control programs, it has helped to increase the number of animals available for food purposes. The labors of veterinarians of this department in practically eliminating bovine tuberculosis from our land have made the hunchbacked child of yesteryear merely an unpleasant memory. Bovine brucellosis is being attacked vigorously on all fronts, and we can look forward to the day when this disease, too, will have a low incidence. The purple stamp of the Bureau's meat-inspection service, indicating that a carcass has been inspected and passed, commands the faith of the consumer in his meat supply. The general area of poultry inspection and sanitation has not yet received the attention which it so sorely deserves, with the voluntary program of the Production and Marketing Administration of the U. S. Department of Agriculture controlling less than 20% of the poultry consumed in the United States. This situation will not be improved until states and municipalities supplement federal inspection programs with strong programs of their own.

In 1946, the United States Public Health Service established a veterinary public health program within its organizational framework. While the activities of this section have not been limited to the areas of food control, much attention has been given and will be given to the diseases of animals transmissible to man through milk, meat, poultry, and other foods of animal origin. In the future, additional emphasis will be placed on the control of such diseases as brucellosis, Q fever, anthrax, parasitic infections such as trichinosis, and those diseases transmissible to man through meat, poultry, and their by-products.

Veterinary officers of the Public Health Service are assigned to research and investigative facilities throughout the nation. Close liaison is maintained with the Committee on Milk and Food Hygiene of the American Veterinary Medical Association, and similar committees of the Conference of Public Health Veterinarians and the U. S. Livestock Sanitary

Association, whose joint efforts to reduce some of the hazards of food-borne diseases have helped to perform a valuable service for the people of the United States. The Division of Sanitation of the U. S. Public Health Service will continue to attack food-borne diseases which can be transmitted through the eating and drinking establishments of the nation.

Army and Air Force Veterinary Services

Traditionally, the United States has taken great pride in being one of the most peace-loving nations of the world; however, our basic veterinary history, in many respects, seems to be more military than civil. There are many facts to support this observation.

During the war periods, from the Revolutionary War through World War I, the quality of veterinary medical service in our nation increased by leaps and bounds. Early in World War I, to meet the Army's increased responsibility to supply our troops abroad with safe and wholesome food, the Meat and Dairy Products Inspection Division was organized as a part of the Army Veterinary Corps. Among the many obstacles it had to overcome were the facts that (1) there was little time for planning, (2) too few trained men were available, and (3) a school for inspectors had to be started simultaneously with extension of the work. Nevertheless, the "service accepted full responsibility for the quality and condition of meat and dairy food products supplied the Army and discharged it with a degree of skill and fidelity that afforded complete protection to the health of the troops[3]." That high reputation still stands.

The addition of an air arm to the Armed Forces has been responsible for the formation of an Air Force Veterinary Section. Today, Air Force and Army veterinarians work side by side to accomplish certain, vital, highly technical tasks for those services—tasks which require knowledge and skills peculiar to the veterinary profession. Of primary importance is the safeguarding of the health of troops from food-borne sickness and disease. In addition, the Veterinary Corps have served with distinction in re-establishing the veterinary services of war-devastated countries, including revitalization of their livestock and food industries.

Educational Aspects

Despite the many accomplishments mentioned above, the rightful place of the veterinarian in public health work has not been fully realized. The role of the veterinarian in preventing food-borne illness will be, and should be, greater in the future than it is today. This will depend on how rapidly and how well the schools of veterinary medicine and public health alert the veterinarian to his potential contribution to the health of mankind.

There seem to be two main sources for the development of veterinarians who are qualified as public health technicians: First, our schools of veterinary medicine, which must continue to promote education in public health and to develop an over-all social responsibility among students in their training period, to assure a supply of veterinarians in private practice who will be well able to take their rightful place in mobilizing a community to protect its health; and second, our graduate schools of public health, which must offer the graduate veterinarian who chooses public health as his career a sound background in public health administration and the tools for working in harmony with the other professional members of the public health team.

Veterinarians must seek and accept positions as qualified staff members of schools of public health and veterinary medicine. There is a place for the veterinarian, also, on the faculties of our medical schools, to establish the closer medico-veterinary relationship so necessary to the welfare of man, who continues to live with and depend on animals for his very existence.

Research

That veterinarians have made major contributions in the fight against food-borne disease can not be disputed. Nonetheless, it is recognized that no scheme of practice in preventive medicine is complete unless it includes opportunity and provision for the investigation and the acquisition of new knowledge. Prevention of tremendous losses of milk, eggs, meat, and other animal-food products will do much to alleviate the increasing food shortage. This can be accomplished by strengthening the research programs of veterinary colleges, graduate schools in the physical and biological sciences, and industry which has contributed substantially to the production of quality foods in plentiful amounts. Above all, it must be remembered that the results of research must be readily understood, utilized, and available for practical application. "Veterinary education properly nurtured through research will advance preventive medicine and consequently the profession[4]."

Summary and Conclusion

Since man first inherited the earth, worthwhile contributions have been made in the conservation and increased production of his food

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supply. The influence of the veterinary profession is more than worthy of note by those persons who dedicate their lives toward the promotion of the public health.

Food-control activities of local, state, and federal governments utilize the skills of the veterinarian to real advantage in the execution of their programs. The private practitioner of veterinary medicine is the bulwark against the introduction into trade channels of diseased animals. Without his support, no food-control program can hope to be successful. Military preventive medicine has helped materially through the years to reduce the incidence of food-borne maladies. Research in this field, if properly applied, will increase the amount, quality, and safety of food supplies of animal origin.

It would be superfluous to review, at this time, attainments of the profession. The work of John Mohler, Maurice Hall, Karl Meyer, and numerous others, speaks for itself. Nevertheless, we can not afford to rest on past accomplishments. Rather, let these accomplishments serve as stimuli for future operations, big and little. In this regard, it would be difficult to improve upon the words of U. S. Supreme Court Justice Oliver Wendell Holmes who, on the occasion of his 90th birthday in 1931, said to a radio audience:

"The riders in a race do not stop short when they reach the goal. There is a little finishing canter before coming to a standstill. There is time to hear the kind voice of friends and to say to oneself: 'The work is done.' But just as one says that, the answer comes: 'The race is over, but the work never is done while the power to work remains'."

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Vibrio fetus

(Continued from page 358)

Summary

Thirty-four strains of Vibrio were tested against 25 antisera prepared in rabbits. Thirty of the strains were closely related serologically. However, variations in agglutinability shown by 20 of 30 *Vibrio fetus* strains indicate that a strain to be used as an antigen should be tested against a large number of bovine or rabbit antisera. Strains should be agglutinated to a fairly high titer by all test antisera if they are to be considered as possible antigens. Our results to date show ten strains that meet this requirement.

Some strains isolated from the bovine genital tract are serologically unrelated to fetal strains. They are probably saphrophytic and it is possible that they never induce abortion. They are so distinct serologically that it is doubtful if they would ever cause confusing results in the agglutination test.

Although only a limited amount of work has been done on the serological relationships of somatic antigens, results indicate that some of the strains may have common antigens.

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Studies On Leptospirosis In Domesticated Animals
I. Leptospirosis In Sheep*

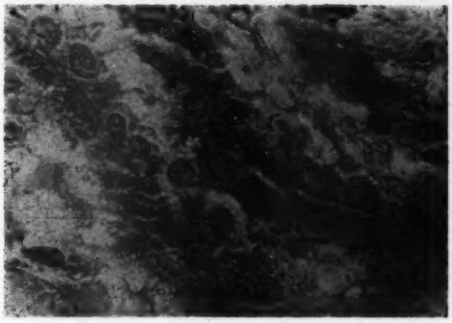
PAUL D. BEAMER, D.V.M., Ph.D., HARRY HARDENBROOK, JR., D.V.M., M.S., and C. C. MORRILL, D.V.M., Ph. D., Urbana, Illinois

LEPTOSPIROSIS has been listed as a disease of rats, dogs, and man for many years. More recent reports[1,2,3,4] of leptospirosis in other domestic animals prompt the reporting of Leptospira infection in sheep.

In October, 108 young ewes were shipped by train and truck from New Mexico, by way of Denver, to a farm in western Illinois where they were bred. They were fed a ration of medium to good alfalfa hay and a pound of mixed corn and oats per head per day. Early in March three of them died. The owner reported that these ewes went off feed, became listless and weak, and died after approximately a week of illness. Three or four others developed similar symptoms and died in late March. No other information was available concerning these first deaths.

Soon after the first of April abortions began. Impending abortions could be detected by careful examination of the udder for congestion and milk secretion. Placental membranes were usually passed within a few hours of abortion, but one or two ewes developed a purulent greenish-white vaginal discharge. Approximately 24 hours after abortion, affected ewes became depressed, failed to move with the flock, and began to lose condition. Progressive emaciation terminated in death in 15 or 16 of the 19 clinical cases occurring in March and April.

Postmortem examination of five of these ewes revealed icterus, swollen kidneys, mild fatty changes in the liver, and marked hematuria. Some animals presented small areas of bronchopneumonia. The presence of pathogenic microorganisms was not revealed by culture of the liver, spleen, kidney, lung, uterine wall, and cotyledons on horse blood agar or McConkey's agar incubated in atmosphere, or by culture of the uterine wall and cotyledons on tryptose agar and tryptose crystal violet agar incubated in atmosphere and 10% carbon dioxide. Histologic examination of kidney sections stained by Levaditi's method did not reveal Leptospira. Postmortem examination of aborted fetuses revealed lesions similar to those noted in the affected ewes. Darkfield examination of the stomach contents of one fetus revealed motile organisms morphologically resembling Leptospira. A guinea pig inoculated subcutaneously with the stomach contents of this fetus died three days later. Histologic examinations of kidney sections from this guinea pig stained by Levaditi's method revealed the presence of the suspected organism. (Fig. 1) Similar examination of three other aborted fetuses revealed forms which were suggestive of Leptospira but could not be identified with certainty. Cultures were not made.



Kidney section stained by Levaditi's method reveals presence of Leptospira.

Serum samples from 11 ewes were submitted to Dr. Karl Reinhard, National Microbiological Institute, Rocky Mountain Laboratory, Hamilton, Mont., for the Leptospira agglutination-lysis test. Doctor Reinhard reported the following results: Negative, two; 1:10, seven; 1:100, one; 1:1000, one. The owner sold the entire flock shortly after this test was made, precluding later agglutination-lysis tests. Although Leptospira were not demonstrated by cultural methods, the authors believe that the symptoms, lesions, agglutination-

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lysis reaction, and demonstration of leptospiral forms from an aborted fetus warrant a diagnosis of leptospirosis.

It is interesting to note that in late November and early December a disease in calves owned by the same farmer had been tentatively diagnosed as leptospirosis. These calves had been managed in part by the same attendants who later had managed the ewes described above. There was no other contact between the calves and ewes. The symptoms exhibited by affected calves had included dehydration, hematuria, depression, and death. Appetites had remained fairly good until the terminal stages. Temperatures had been elevated to approximately 105 F. early in the course of the disease but had dropped to 98 F. before death.

Postmortem examination of one of these calves revealed mild icterus and fatty degeneration of the liver. Examination of the erythrocytes failed to reveal presence of Anaplasma. Bacteriological examination was negative for aerobic and anaerobic pathogenic microorganisms. Isolation of Leptospira by cultural methods was not attempted. Attempts to demonstrate Leptospira by guinea pig inoculation were unsuccessful. A serum sample from one calf was submitted to Dr. Karl R. Reinhard, who reported a positive agglutination-lysis reaction in 1:1000 dilution, and a trace reaction in 1:10,000 dilution. Treatment of affected calves with blood transfusions, intravenous fluid therapy, and streptomycin was reported to be effective if started early in the course of the disease. On the basis of history, symptoms, lesions, and positive agglutination-lysis reaction, tentative diagnosis of leptospirosis was made even though the causative organism was not demonstrated.

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Whatever interpretation may be made of the results derived from brucella mucoid and strain 19 vaccines, present vaccinal use can be accepted only as an adjunct to the problem of brucellosis control in cattle.—*B. H. Edgington, D.V.M., Wooster, Ohio.*

Immunity, Hog Cholera Vaccine

(Continued from page 359)

five unvaccinated controls, which had been in contact during the entire period, were challenged. In this case, the challenge dose was 2 cc. of the challenge virus. Here again, vaccinees were symptom free, while all contract controls succumbed and showed lesions indicative of hog cholera on autopsy.

Findings from these experiments are summarized in the accompanying table.

Comment

These studies indicate that durable immunity to hog cholera for at least two years was conferred by vaccination with a modified live virus vaccine, which had been serially passed in rabbits 250 times. It is apparent that this immunity was the result of vaccination alone, as there was no chance exposure to hog cholera virus since all contact control animals remained susceptible throughout the experiment. By analogy with results obtained with other live virus vaccines in both man and animals, it is probable that rovac will confer immunity which, for all practical purposes, may be regarded as lifelong for the hog.

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Advocates of the intra-arterial route of transfusion claim that tissue perfusion rates are thus elevated more quickly and readily than by the routine intravenous method. In a series of rigidly controlled tests on dogs, Dr. S. J. Sarnoff found that shock conditions responded equally well to intra-arterial and intravenous routes, and that the arterial route did not elevate coronary flow or arterial pressure either more rapidly or more effectively than the venous route.

Doctor Sarnoff reports that intravenous routes are as rapid as intra-arterial. Although not contraindicated, the technic of intra-arterial puncture might entail delay far outweighing the advantages. — *Jour. Am. Med. Assn.*, 151:26 (Mar. 28), 1953.

Electron Microscopic Studies Of The Hemagglutination-Inhibition (H. I.) Test For Newcastle Disease Virus (NDV)

REGINALD L. REAGAN, Major, U. S. Army, Ret., and
A. L. BRUECKNER,* D.V.M., College Park, Maryland

ALLANTOIC fluid, infected with Newcastle disease virus, causes agglutination of a suspension of chicken red blood cells when mixed in a test tube at room temperature. Since the original discovery by Hirst[1] in 1941 of agglutination of chicken red blood cells by influenza virus, the phenomenon has been extensively investigated, and it is now known that red blood cells of chicken, man, guinea pig, and several other species are agglutinated by influenza, mumps, and Newcastle viruses. When virus agglutinates red cells, there is a relatively firm adsorption of the virus to the surface of the cells or the so-called "receptors." Within 15 to 45 minutes, red cells sediment in clumps to the base of the tube, and supernatant fluid becomes clearer. One of the main

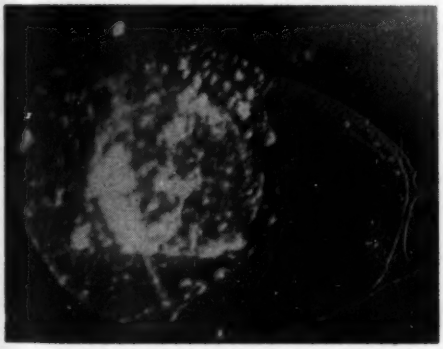

Fig. 1. Red blood cell from tube containing saline and cells. X 18,000.

practical uses of the chicken red cell agglutination (CCA) phenomenon is in titrating the antibody content of Newcastle immune sera. When positive sera, virus, and red cells are mixed as specified in the test, no agglutination takes place. The test may be conducted by either of two methods: by using constant amounts of virus and varying the quantities of sera, or by using constant amounts of sera and varying the quantities of virus. It is possible to determine the titer of the virus when the inhibiting power of the serum is known, or to determine the inhibiting power of a serum when the titer of the virus is known.

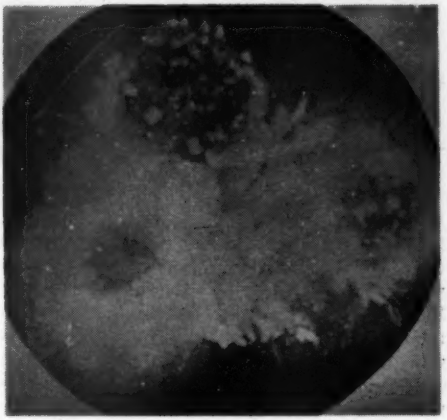

Fig. 2. Agglutinated red blood cells from tube containing virus, saline, and cells. X 16,000.

Materials and Methods

The H.I. test used in the present study was conducted as advocated by the Bureau of Animal Industry, Washington, D. C[2]. Constant amounts of serum and varying quantities of virus were used. Red cells from ten-week-old chickens were used. At completion of the test, supernatant fluid was removed from each of the control tubes and from each tube containing the 1:10, 1:20, 1:40, and 1:80 dilutions of virus. With small capillary pipettes, the red cells from the tubes were deposited on parlodion film supports prepared 24 hours previously. The red cells were allowed to dry on the screens for two hours and were then shadowed with chromium at arc tan 2/10[3]. They were then examined under an RCA electron microscope, type EMU. The 1:20 dilu-

*Maryland State Board of Agriculture, Live Stock Sanitary Service Laboratory, University of Maryland.

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tion was found to be the optimal dilution, and the above experiment was repeated three times using the controls and 1:20 dilutions of virus.

Results

Figure 1 shows a single red blood cell from the tube containing saline and cells. Figure 2,

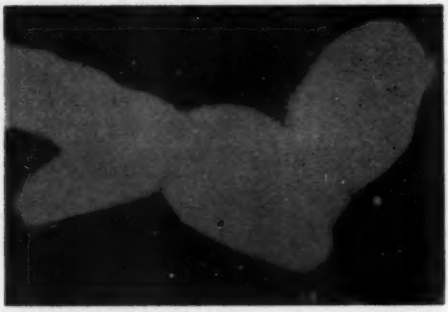

Fig. 3. Agglutinated cells from tube containing negative serum, virus, and cells. X 10,000.

from the tube containing virus, saline, and cells, shows three agglutinated red blood cells with virus-like particles adhering to the surfaces of the cells. Figure 3, from the tube containing negative serum, virus, and cells, presents a similar picture. Figure 4 shows a single red blood cell from the tube containing positive serum, virus, and cells.

Summary

Electron micrographs of red blood cells from the H.I. test for NDV are presented.

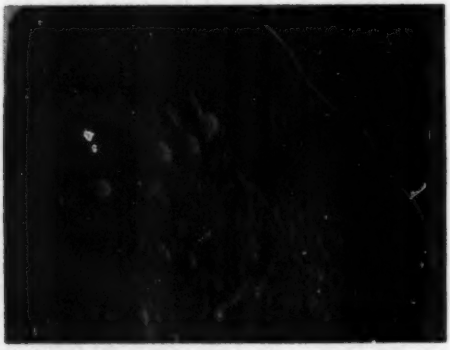

Fig. 4. Red blood cell from tube containing positive serum, virus, and cells. X 22,800.

Virus-like particles were evident as adhering to the surface of agglutinated red blood cells from mixtures of virus, saline, and cells and of virus, negative serum, and cells. No virus-like particles were evident in the controls or in the mixture of virus, positive serum, and cells.

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Atrophic Rhinitis of Swine

(Continued from page 351)

Additional experiments are in progress to determine whether *S. necrophorus* by itself, or in association with *P. multocida*, will produce atrophic rhinitis. That synergistic activity exists in mixed infections yielding *S. necrophorus* has been demonstrated by Hite, Lock, and Hesseltine[9].

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As much as 100 cc. of blood can be withdrawn by intracardial puncture from a donor cat, if the volume is replaced by an equal amount of gelatin; otherwise, 50 cc. is the amount safely withdrawn. — *C. H. Clark, D.V.M., Columbus, Ohio.*

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The USDA, on the Tenth National Farm Safety Week calendar, advances this oft-ignored advice: "Bulls and tractors are powerful things. Treat them with respect."

Bacitracin: Its Use In Control And Treatment Of Swine Enteritis

I. S. ROSSOFF, D.V.M., and WILLIAM ABEL, D.V.M.,
Taylorville and Morrisonville, Illinois

DUE to the inability of available therapeutic agents to satisfy completely the demands of swine enteritis therapy, attention has focused on bacitracin. Several years ago the authors' clinic used (with poor results) antibiotic fermentation solubles and press cake for control of acute hemorrhagic dysentery. At that time emphasis was placed on the vitamin B_{12} activity of these products. When aureomycin residues became available, with stated antibiotic activity analysis, therapeutic results improved. This product helped overcome stunting, but in cases of acute hemorrhagic enteritis results were not too encouraging unless concurrent therapy with sodium arsanilates was instituted.

Evidence had been accumulating on the relative safety and effectiveness of oral bacitracin for intestinal infections. Chronic toxicity studies following oral administration of bacitracin to mice, rabbits, and dogs indicated unusual safety even after prolonged daily administration[11,12]. Bacitracin as a dry powder has unusual stability and is relatively resistant to trypsin, pepsin, and many other proteolytic enzymes[3]. It is compatible with sulfaquinoxaline, nitrofurazone, nitrophenide, arsanilates, and many other drugs commonly used in treatment of enteric conditions in animals. Bond *et al.*[1] found that bacitracin persists in the feces of dogs for as long as three days following cessation of oral administration; virtually none of the orally administered bacitracin was absorbed from the intestinal tract. These features alone indicated great potential usefulness in therapy of swine enteritis.

Oral bacitracin produced unusually favorable responses to amebiasis in man[10,13,9]. It was also noted that therapy eliminated clostridia and enterococci from stools[10]. In 1950, a report of the first successful treatment of two cases of enterocolitis in man, caused by *Balantidium coli,* was issued[3].

In the veterinary field, case reports on the use of oral bacitracin are very limited. Konde[6,7] suggests that it is extremely effective in a large percentage of canine diarrheas. Graham, Boley, and Woods[5] reported excellent results obtained with oral bacitracin in a serious outbreak of hemorrhagic enteritis in swine. Results were compared with various oral levels of sodium arsanilate, sulfamethazine, and sulfathalidine. Adequate control groups were arranged. Sodium arsanilate produced control almost as well as high level bacitracin therapy for the short duration of their experiment, except that slight evidence of unthriftiness continued in the group treated with arsanilates. Clinically, bacitracin therapy was far superior to results obtained with either sulfathalidine or sulfamethazine.

Treatment

Because of economic limitations, the authors decided to use a new bacitracin salt with a stated antibiotic activity, rather than the purified drug. Since reasonably good mixing was desirable, an antibiotic base which was light and fluffy, with a medicinal appearance and distinctive coloring, was sought. This was obtained with standardized potency of 5 gm. of bacitracin activity† per lb.

Objectives in treatment of swine dysenteries were: (1) Rapid control of the infective process; (2) control of dehydration and electrolyte disturbance; (3) overcoming stunting aftereffects; (4) ease of administration in large herds; (5) in some cases, continual prophylactic therapy to prevent relapse; (6) relatively inexpensive therapy; and (7) a non-toxic agent for prolonged therapy.

Bacitracin met the objectives of enteritis therapy in our practice much more completely than did the use of sulfonamides, arsanilates, or vitamin B_{12} preparations. Continual therapy by feed administration with no toxic effect was easily accomplished. Its antibiotic activity in great measure helped overcome stunting effects of various dysenteries. Rapid control of infective agents was attained. It proved

†Bacitracin-D.P.S. is a new bacitracin salt manufactured by S. B. Penick & Co., New York. The product used in these studies was furnished by the Illinois Antibiotic Co., Taylorville, Ill.

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to be relatively inexpensive for long term therapy.

In administration of the drug, it was preferred that the entire ration be ground, although in some cases an adjusted amount of antibiotic was added to the supplement alone. Acute cases showing anorexia and acute hemorrhagic enteritis were treated simultaneously with sodium arsanilate (9.13 gr. per gal. of drinking water) until clinical symptoms subsided. Bacitracin was initially added to the ration at a higher level, and was reduced by one-half after clinical symptoms were controlled. It was found in treatment of suckling pigs that a high level of bacitracin had to be added to the ground creep ration due to limited amount of dry feed consumption. In

TABLE 1. Summary of Field Use of Bacitracin* for the Control of Swine Enteritis

Diagnosis	No. Affected	No. Herds	Age	Level of Bacitracin
Acute hemorrhagic dysentery	463	5	3-7 mo.	100 gm. per ton initially; later, 50 gm. per ton.
Necrotic enteritis	90	1	6-8 mo.	50 gm. per ton.
Infectious baby pig scours	530	9	3-7 wks.	100 gm. per ton.
Postvaccinal enteritis	44	1	6-8 mo.	50 gm. per ton.
Non-specific enteritis following weaning	216	2	8-16 wks.	12.5-25 gm. per ton.
Enteritis of garbage-fed hogs	6	1	4-6 mo.	50 gm. per ton.

*Bacitracin-D.P.S.-Penick

severe outbreaks, arsanilates were added to water and placed in shallow pans before the suckling pigs. Polydipsia existed in these pigs and in an attempt to replace fluid loss, they would drink freely. Those pigs too young or too sick to eat dry feed were treated by forced oral medication with arsanilates and sulfonamides. In one case of necrotic enteritis, pneumonia became a complicating factor and sodium sulfathiazole was added to the drinking water at the rate of .75 gr. per lb. of body weight per day for three days.

Discussion

1. In outbreaks of hemorrhagic dysentery, 3 to 5 % of the treated hogs relapsed over a period of three to four months. These were segregated and retreated from one to three times with sodium arsanilate.

2. Outbreaks of necrotic enteritis were in southern feeder hogs recently shipped. Complete control was attained within five days.

3. In infectious baby pig scours, medication was given in the creep feed. Higher levels were used due to limited feed intake.

4. Postvaccinal enteritis occurred following use of simultaneous serum-virus immunization during a hog cholera outbreak.

5. Non-specific enteritis cases were mild ones, following weaning.

6. Garbage-fed hogs responded, after failing to respond to arsanilate therapy for seven days.

The problem presented by hemorrhagic dysentery is one of repeated attacks following initial clinical control with arsanilates, and one of severe stunting. With use of arsanilate therapy alone, it was found that symptoms reappeared five to 14 days after cessation of water medication. In many cases, stunting had made the hogs economically worthless although no further clinical diarrheas had been noted. Use of bacitracin in these cases was aimed primarily at prevention of stunting and control of further clinical outbreaks after initial control by simultaneous use with arsanilates. In most of the outbreaks it was found necessary to use arsanilates for only two to three days. This water therapy was also necessary because of anorexia in many of the cases.

Most of the cases of swine enteritis encountered evidenced good clinical control within two to four days. Some individuals required up to five or seven days for complete control of symptoms. Growth stimulation, greater activity, and a marked increase in feed consumption was usually apparent within three days after institution of therapy.

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(Continued on page 375)

Hepatic Coccidiosis In Mink

C. L. DAVIS, D.V.M., T. L. CHOW, D.V.M., Ph.D., and JOHN R. GORHAM, D.V.M., M.S.*

MINK, like many other carnivora, are susceptible to coccidiosis. While no certain single species of the parasite has been incriminated thus far, species similar to the dog and cat forms (Isospora) have been found in this animal[1]. Levine[2] found oocysts of four species of coccidia in the intestinal tract of a mink dead of hemorrhagic gastroenteritis. These were identified as *Eimeria vison* (Kingscote 1934), *E. mustelae* (Iwanoff-gobzen 1934), *Isospora laidlawi* (Hoare 1927), and *I. bigemina* (Stiles 1901). Prior to the use of wire flooring as a sanitary measure in pen construction, the disease caused severe losses, particularly among kits, in many minkeries[3]. The likely source of infection is from adult carriers which may harbor coccidia in the intestinal tract without exhibiting symptoms. Infection takes place through ingestion of feed and water contaminated with infective forms (oocysts) of the protozoan organism.

The parasites invade and destroy epithelial cells of the intestinal mucosa, resulting in sloughing and consequent diarrhea, which is frequently of bloody character in acute infections (fig. 1). The infection is, as a rule, confined to the intestines in most species of animals and birds, but not infrequently may also involve the liver in rabbits and the kidneys in domesticated geese[4]. Recently, one of us (Davis) observed renal coccidiosis in a wild mallard duck as an incidental finding among several ducks that died of another condition. In the rabbit, liver coccidiosis is considered to be a chronic manifestation of the disease. It is generally believed that the infection reaches the liver from the intestines by way of the common bile duct and its branches. However, Smetana[5] produced experimental coccidiosis in the liver of rabbit by infecting the biliary tract after injecting liberated sporozoites into a mesenteric vein. In either event, invasion of bile duct epithelium by the rapidly multiplying parasites stimulates cell proliferation and consequent thickening and widening of the ducts. New bile ducts form, producing white, rather

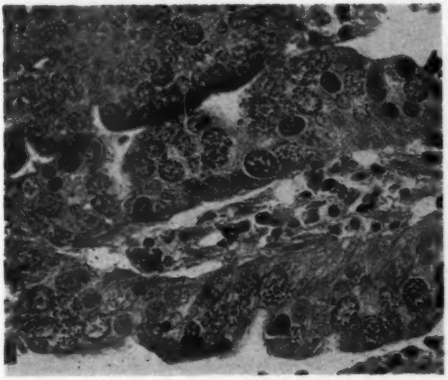

Fig. 1. Intestinal coccidiosis in a mink showing heavy invasion of epithelium of the villi with coccidia. This section is from an acute fatal case in which infection was confined to the intestines. (X550)

*From the Branch Pathological Laboratory, BAI, Agricultural Research Administration, USDA, Denver Federal Center, Denver, Colo. (Davis), and the Department of Veterinary Science, University of Wisconsin, Madison (Chow and Gorham). Doctor Gorham, in charge of the Fur Animal Disease Research Laboratory, Pullman, Washington, returned to his station March 1, 1953.

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firm, nodular formations having the appearance of neoplastic tissue. Coccidiosis of the liver in animals other than the rabbit is apparently of rare occurrence, and the finding of two such cases in mink forms the basis of this report.

Report of Two Cases

Case 1. The subject was a nine-month-old female mink that died after a lingering illness of two or three months duration. Clinical signs were rather vague, but the owner stated

Fig. 2. Liver of mink from case 2 showing enlarged bile tracts and roughened, nodular appearance of the surface.

Fig. 3. Cut surface of the liver in case 2, showing irregular greyish-white areas.

that the animal showed gradual loss of weight and was in extremely poor physical condition at the time of death, which occurred in January 1948. Postmortem examination made in the Branch Pathological Laboratory of the U. S. Bureau of Animal Industry, Denver, Colo., revealed an extremely emaciated carcass with an obviously diseased liver. Slight postmortem changes had occurred prior to necropsy. The common bile duct and its main branches were markedly thickened. The larger biliary tracts were, for the most part, patent and purulent exudate could be expressed from their lumina. In areas where several thickened ducts were in close apposition, lesions appeared as white, firm, neoplastic-like nodules and a tumorous condition arising from the bile ducts, possibly carcinoma, was strongly suspected. The remainder of the liver revealed a roughened surface and was rather firm. No thought was given to the possibility of biliary coccidiosis, and consequently neither the intestinal content nor the exudate in the bile ducts was examined for presence of oocysts. Other visceral organs appeared essentially normal, and only the liver, with attached bile duct, was saved for histologic examination.

Case 2. This adult female was found dead about a week before scheduled pelting (November 1951) at a fur farm near Madison, Wis. The owner opened the carcass and reported what "looks like cancer of the liver." The mink was then submitted to the Department of Veterinary Science, University of Wis-

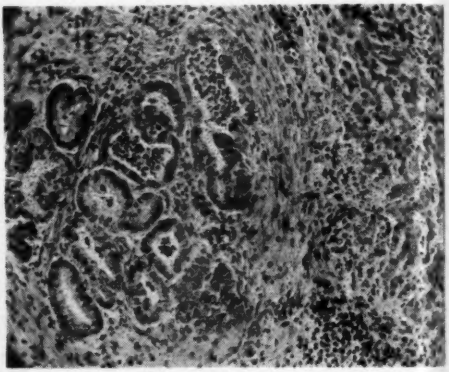

Fig. 4. Section of a small nodular area in the liver from case 2 showing an encapsulated group of newly-formed bile ducts. Note purulent exudate in the lumen with a few coccidia visible among the pus cells. (X180)

consin for necropsy. Upon examination of the abdominal viscera, the most significant findings were the presence of an enlarged liver and bile ducts (fig. 2). The gall bladder could not be distinguished from the enlarged bile ducts. The surface of the liver appeared pale and mottled and contained several irregular, whitish, elevated areas, measuring .25 to 1 cm. in diameter. One of the lobes presented a granular appearance on its diaphragmatic surface. Bile ducts were enlarged, white, and firm.

On cut section, the liver exhibited irregular, greyish-white, circumscribed areas ranging in sizes up to more than 1 cm. (fig. 3). Grossly, it appeared similar to bile duct carcinoma. Greatly enlarged bile ducts, while following their natural anatomical position,

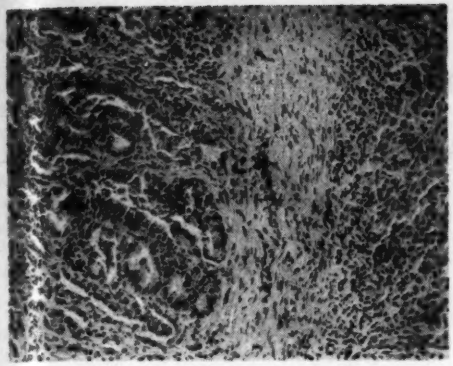

Fig. 5. Section of a nodular area from the liver of case 1 showing striking resemblance to fig. 3. Cellular clarity is somewhat obscured by postmortem change. (X180)

appeared to radiate in the liver parenchyma as a coral tree.

No other visible lesions were observed in the thoracic or abdominal cavities, except the hepatic, anterior mesenteric, and gastric lymph nodes which were enlarged. The small and large intestines appeared slightly thickened, but as coccidiosis was not suspected, examination of intestinal content for the presence of oocysts was not made before it was placed in fixative†.

Histopathological Findings

Microscopically, sections of thickened bile ducts and nodular lesions in both cases were essentially the same, the degree of involvement being greater in case 2. The affected bile tracts were thickened by hyperplasia of the epithelium, arranged in a tubular pattern for the most part, and by a cellular infiltrate consisting principally of plasma cells. The lumina of the hyperplastic ducts were often plugged with purulent exudate or necrotic debris containing numbers of coccidial forms (fig. 4 and 5). In addition, many cells of the proliferative epithelium were invaded by coccidia (fig. 6 and 7). The smaller nodular areas were also made up of hyperplastic bile ducts and aggregations of plasma cells. These were seen to arise primarily in the portal spaces. Even in the smaller foci, coccidial forms were occasionally seen in the lumina of the ducts, as well as within the epithelial cells. Nodular areas were usually surrounded by a well-defined, fibrous capsule. This suggests spread of the infection from the larger biliary tracts to smaller radicals.

†The authors wish to express their appreciation to Dr. S. H. McNutt of the Department of Veterinary Science, University of Wisconsin for reviewing the sections of case no. 2.

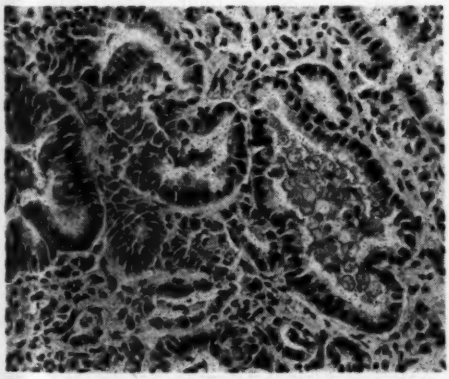

Fig. 6. A hyperplastic area in the liver of case 1 showing the lumen of a bile duct plugged with coccidia. (X350)

Discussion

It is of interest that the prosectors in both cases suspected a neoplastic condition of the bile ducts upon gross examination of the liver. Even microscopically one might think of neoplastic proliferation of bile duct epithelium, were it not for the presence of coccidia to explain the cause for reactive hyperplasia. It is common knowledge that irritation of the biliary tracts caused by obstruction or inflammation may result in proliferation of bile duct epithelium. It is to be admitted that to draw the line between hyperplastic tissue and frank neoplastic proliferation is often difficult, especially where no inciting factor is apparent.

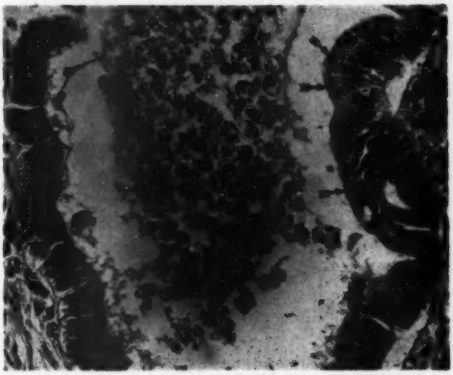

Fig. 7. Section of a single hyperplastic bile duct in case 2 showing coccidia in the lumen exudate as well as parasitized epithelial cells (indicated by arrows). (X410)

Summary

1. Coccidiosis of the liver in animals, other than the rabbit, appears to be of rare occurrence.

(Continued on page 375)

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Treatment Of Canine Pannus

RUSSELL N. ABBOTT, D.V.M., Rockland, Maine

PANNUS, or vascular keratitis, is a relatively uncommon disease in the canine patient. Antibiotics, both systemically and locally, ophthalmic ointments, vitamins, foreign protein, and numerous other treatments have been used, but prognosis has remained guarded. In the author's experience, most cases thus treated eventually were submitted for euthanasia or remained permanently blind. With hydrosulphosol®[1] treatment, however, cases have not presented the problems previously encountered.*

Value of the —SH radical in nutrition of the tissues has been known for many years. In 1942, Mellon,[1] in collaboration with the Mellon Institute of Industrial Research, had, as an objective, the exploration of a new sulfhydryl-yielding solution (hydrosulphosol) for use particularly on burns. Scientists acquainted with the chemical structure of this product classified it as a chemotherapeutic agent. Early *in vitro* tests indicated that it was too weak to be termed bactericidal. Later confirmation by Mellon and associates showed that hydrosulphosol was antiseptic.

Although the first published reports by the E. C. Lientz Sales Company refer to sulfhydryl as the active ingredient, with the aid of the Council on Pharmacy and Chemistry, it was established that the importance may be shared equally by the two components calcium and sulfhydryl. The generic name thus recognized by the Council is calsulfhydryl. This recognition was authorized by the Council and, in the *Journal of the American Medical Association*[2] under New Generic and Brand Names Recognized by the Council, it lists: "Calsulfhydryl for the compound aqueous dispersion of sulfur complexes of calcium polysulfides and thiosulfates containing a labile sulfhydryl group: Hydrosulphosol."

The work with hydrosulphosol products in the ophthalmological field was pioneered by A. E. Cruthirds, M.D.[3,4]. His reports indicated its use in treatment of ocular complications. These and later efforts on his part have led to achievements which have been recognized by ophthalmologists as opening a new approach to this specialty. Although many reports are available concerning use of hydrosulphosol in human ophthalmology, the extent to which it is being used in the veterinary field is not known.

In this report, there are presented histories of four cases of canine pannus treated in the past 16 months. It is agreed that the number of cases described does not warrant any basis for complete evaluation of the product; however, since the occurrence of pannus is relatively infrequent, it was decided to present the evidence at this time in the hope that other practitioners may become interested in its use. At a later date, a larger number of cases may be reviewed.

Method of administration in all cases was identical. Hydrosulphosol-oral was administered in gelatin capsules, five drops three times daily. (Empty gelatin capsules were dispensed to be filled by the client immediately before use.) It will be noted in case 4, however, that medication was mixed with the feed, to which the patient did not object. Local treatment consisted, in each case, of one drop hydrosulphosol-ophthalmic solution in the affected eye daily. No other medication was given during treatment.

Case 1. Six-year-old female German Shepherd with bilateral pannus. Extreme vascularization and grayness of entire cornea, ectasia. Condition had been progressing for a month, and was not presented until complete blindness was apparent. Light would not penetrate the cornea at any point. Primary medication consisted of 150 mg. aureomycin®[2] four times daily, phe-mer-nite and phenacaine®[3] ophthalmic ointment three times daily, and 1 cc. hypobeta®[4] at two-day intervals. After six days treatment no improvement was noticed and the patient showed extreme ocular sensitivity. Hydrosulphosol treatment was instituted. In one month, vascularization had completely disappeared and grayness was less dense. After two months of treatment the cornea was clear except for a few minute patches of gray. Sight was apparently normal.

®[1]Hydrosulphosol, brand of sulfhydryl, distributed by E. C. Lientz Sales Co., Fillmore, Calif.

*Appreciation is extended to Oliver K. Lientz of the E. C. Lientz Sales Company for background material and reference sources.

®[2]Lederle Laboratories Division, American Cyanamid Co., Pearl River, N. Y.

®[3]S. E. Massengill Co., Bristol, Tenn.

®[4]Sharpe and Dohme, Inc., Philadelphia, Pa.

Case 2. Eight-year-old mongrel. The patient had been presented for treatment of an entirely unrelated condition but the owner questioned progressing grayness of both corneas. Mild chronic pannus was apparent, with grayness and some vascularity, but was not sufficient to cause complete blindness. Partial blindness had been noted in semi-dark places. Hydrosulphosol treatment was recommended. The author has not seen the patient since, but owner reported that eyes were much clearer, with improved vision.

Case 3. Five-year-old male Beagle. The original condition treated in this case was an acute pharyngitis assumed to be streptococcic. Mild conjunctivitis was also noted. Penicillin and triple sulfonamides relieved pharyngitis immediately. Two weeks later a violent bilateral pannus resulted. Appearance of the eyes was disheartening. The patient, in rubbing the eyes with its paws, had gouged out areas of the cornea and both eyes were masses of inflammatory tissue. Hydrosulphosol treatment was started immediately. In one month, observation of the eyes showed no evidence whatsoever of any previous corneal disturbance except for a shallow cupping about 1/16 inch in diameter in the center of each eye.

Case 4. Three-year-old male Cocker Spaniel. In all respects this was the most disappointing case in the group, not primarily because of poor results, but for lack of cooperation of both owner and patient. This dog from puppyhood had been bothered with chronic conjunctivitis although at no time previously had the cornea been disturbed. Upon presentation, severe pannus was apparent with vascularization, ectasia, and grayness. Complete blindness was assumed. Due to difficulty in handling the dog it was necessary to administer oral medication in feed, and only with force could the patient be held still enough to instill ophthalmic solution. How long the treatment was carried on by the owner is not known, the supply of medication in his hands would have lasted only three weeks. Six weeks after start of treatment owner requested euthanasia, which was performed. On examining eyes at this time, it was observed that the vascularization had disappeared and only a dense gray cornea remained. It is impossible to say whether the condition would have been relieved had treatment been continued, but it was noted that some improvement had occurred.

Hydrosulphosol ophthalmic ointment is now available. If this preparation is as effective as the ophthalmic oil, ease of administration would indicate its use.

Summary

Four cases of canine pannus have been presented. In every case, hydrosulphosol oral and ophthalmic solutions were used in treatment. Two cases, both completely blind upon examination, showed excellent response. One, a mild chronic form, showed improvement, and a fourth was submitted for euthanasia before treatment was complete although some improvement was noted.

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(Continued from page 370)

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Hepatic Coccidiosis in Mink

(Continued from page 373)

2. Two cases of hepatic coccidiosis in adult minks have been reported, including description of the gross and microscopic pathology.

3. The disease is manifested by a neoplastic-like thickening of the common bile duct and its radicals.

4. Diagnosis is based on the presence of coccidia in bile tracts and within hyperplastic epithelium.

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A. V. M. A. Toronto Convention Notes

THE 90th annual meeting of the American Veterinary Medical Association set many new standards to challenge succeeding conventions of the Association. Among these were the record-breaking attendance, splendid facilities available, excellent television demonstrations, and high quality scientific presentations.

Toronto, Ontario, Canada, host city for this year's sessions, fulfilled expectations by providing excellent facilities for the more than 3,400 who attended the conference. Counted among the conferees were 30 representatives from other countries including Argentina, Cuba, the British West Indies, the Bahamas, Hawaii, Holland, Ireland, Israel, Mexico, Peru, Thailand, and West Africa. The previous attendance record of 3,128 was set at Milwaukee in 1951.

Dr. E. Rendle Bowness, general chairman of the Committee on Local Arrangements, handled the myriad of perplexing duties and responsibilities of his position in a praiseworthy manner, and all events took place on schedule. Well-planned entertainment, including golf matches, luncheons and tours for visiting ladies, teenager activities, and special events, was well-received.

Twenty-four affiliated organizations also convened in separate sessions. These included the American Animal Hospital Association, Veterinary Radiologists, American College of Veterinary Pathologists, the American Association of Veterinary Anatomists, Public Health Veterinarians, Extension Veterinarians, Women's Veterinary Medical Association, Veterinary Parasitologists, National Association of Federal Veterinarians, Zoo Veterinarians, Editors, Canadian Veterinary Medical Association (business meeting), Alpha Psi Fraternity, American Board of Veterinary Public Health, National Assembly of Chief Livestock Sanitary Officials, and Veterinary Examining Boards.

Publicity for the convention was handled exceptionally well. Twenty-seven radio interviews with prominent veterinarians were tape-recorded for subsequent broadcasting. Norman Kraeft, Radio Farm Director, Chicago's clear-channel station, plans to distribute recordings to 15 clear channel stations located throughout the United States. Further publicity was made possible by attendance of some of Canada's best newsmen who prepared illustrated features daily for local newspapers and both Canadian and United States press services.

President of the A.V.M.A.

Brigadier General James A. McCallam, U.S.A. Ret.

General McCallam received his veterinary degree from the University of Pennsylvania in 1917. He was appointed assistant veterinarian in the Veterinary Corps, Regular Army, with the rank of 2nd Lieutenant, on July 16, 1917. He graduated from the Army Veterinary School in 1924, and the Army Medical Field Service School in 1925. He served with the Sixth Army in Australia, New Guinea, Leyte and Luzon in the Philippines, and, finally, with the occupation forces in Japan. General McCallam was awarded the Legion of Merit and the Bronze Star Medal for his outstanding service in the Southwest Pacific theater.

At the time of his selection to head the Army Veterinary Corps in 1948, the United States Senate confirmed his promotion to the rank of brigadier general. He is the second military veterinarian and the first general officer to hold the office of president of the A.V.M.A.

General McCallam, who succeeds Dr. W. L. Boyd, retired from active duty with the Veterinary Corps on January 31, 1953. He resides in Washington, D. C.

The President's Address

Dr. W. L. Boyd, in his presidential address to the well-attended opening session, proposed one answer to the nation's increasingly serious problem of feeding a rapidly expanding population. "Improved livestock disease control measures will assist greatly in making possible increased food production," he said.

The recent spectacular spread of diseases of cattle, swine, and sheep in the United States was cited, indicating the vital need for expanded disease research programs. Veterinary research workers have made recent advances against bovine hyperkeratosis, in the development of diagnostic methods for detecting atrophic rhinitis, development or perfection of vaccines for leptospirosis, keratoconjunctivitis, hog cholera, Newcastle disease, canine distemper, and infectious hepatitis.

Doctor Boyd also discussed educational trends in veterinary colleges, pointing to the need for regional education facilities to obtain most benefit for the profession. He recommended that the A.V.M.A. Council on Education explore advantages of regional education plans.

All veterinarians were urged to take an active role in civil defense and to be "ever vigilant and prepared at all times to attack disease whenever and wherever it may appear."

The New Officers

Brigadier General James A. McCallam was installed as president of the A.V.M.A. at the concluding session of the convention. Other officers elected to serve for the ensuing year are Dr. A. H. Quin, Kansas City, Mo., president-elect; Dr. J. G. Anderson, Calgary, Alta., first vice-president; Dr. Peter MacKintosh, Yakima, Wash., second vice-president; Dr. J. F. Shigley, State College, Pa., third vice-president; Dr. John McAuliff, Courtland, N. Y., fourth vice-president; and Dr. J. D. Engle, Summit, N. J., fifth vice-president. Dr. H. F. Kingman, Jr., Chicago, Ill., was reelected treasurer.

Women's Veterinary Medical Association

The new officers of the Women's Veterinary Medical Association are: President, (reelected), Dr. Lois Calhoun, East Lansing, Mich.; Eastern Vice-President, Dr. Lorraine B. Nielsen, Guelph, Ontario, Canada; Central Vice-President, Dr. Norma G. Kopp, Grand Rapids, Mich.; Western Vice-President, Dr. Phyllis H. Larsen, San Diego, Calif.; Southern Vice-President, Dr. Hildegarde Seelig, Asheville, N. Car.; Secretary, Dr. Patricia O'Connor, Staten Island, N. Y.

The Association's annual award of $50. to the women veterinarian who has made a significant contribution to the profession, was given to Dr. Margaret Sloss, a member of the veterinary faculty of the Iowa State College.

President-elect of the A.V.M.A.

Dr. A. H. Quin

Dr. A. H. Quin, Kansas City, Mo., was named president-elect of the American Veterinary Medical Association at the Association's annual convention in Toronto on July 20, 1953.

Doctor Quin, who holds the position of vice-president of the Jensen-Salsbery Laboratories, will bring to the Board of Governors of the national association a wealth of experience ranging from general practice, which he shared for several years with his father in Creston, Iowa, to field veterinary work with Fort Dodge Laboratories and foot-and-mouth disease control work in California. He has been associated with Jensen-Salsbery Laboratories since 1942, having originally joined the staff of that organization to head the professional services department.

One of the most widely known men in the veterinary profession, Doctor Quin has held a number of honorary positions, including those of president of the Iowa Veterinary Medical Association, chairman of the Public Relations Committee of the A.V.M.A., chairman of the Educational Committee of the Associated Serum Producers, and member of the Biological Committee of the U. S. Livestock Sanitary Association and the Missouri State Brucellosis Committee. He received the A.V.M.A. award for outstanding service to the profession in 1951 and the Omega Tau Sigma award at Ohio State University in 1953. Doctor Quin has delivered professional papers at many state and regional association meetings, and contributed numerous professional papers to VETERINARY MEDICINE and other professional publications.

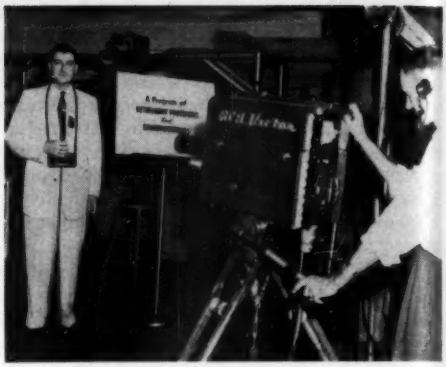
Doctor Quin was born in Creston, Iowa, in 1896. He received his professional degree from the Chicago Veterinary College in 1920, and that same year married Violet Lebedoff. Doctor and Mrs. Quin have two daughters and five grandchildren.

An estimated 57% of jobs that occupy the working population of the United States today did not exist 50 years ago.

Television Program

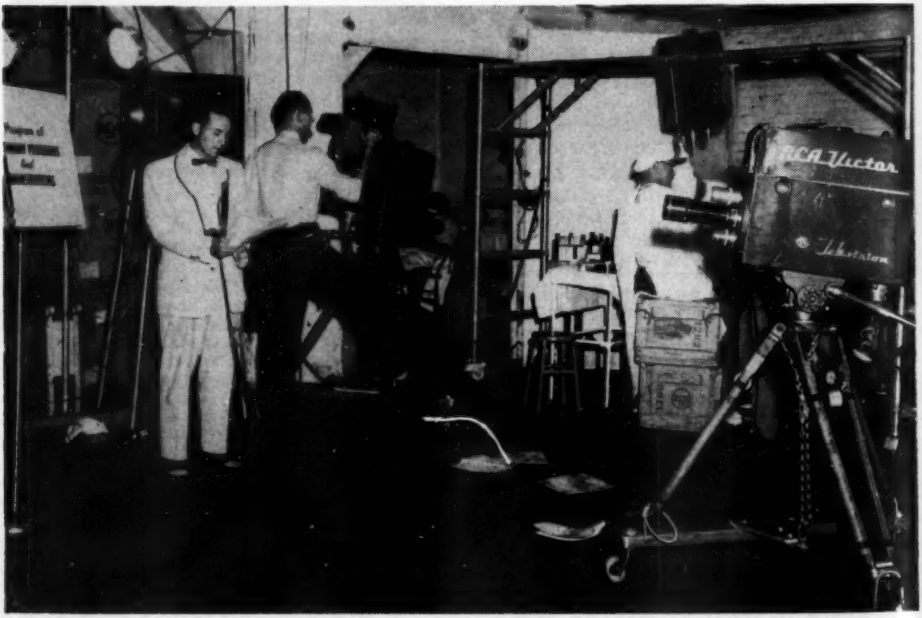
Use of television has become the greatest advancement in effective teaching of the 20th century. In several preceding issues of this journal, attention of readers has been directed to the value of television as an educational media for veterinary audiences. It presents clear, surgeon's-eye views of each operative step as it is performed.

The televised portions of the Section Programs, at the Toronto Convention, comprised a total of six sessions, each including a number of separate demonstrations. These were made possible through the cooperative efforts of Allied Laboratories, Pitman-Moore Company Division, and the Radio Corporation of America.



Dr. L. E. Fisher, Berwyn, Ill., served as coordinator of television demonstrations.

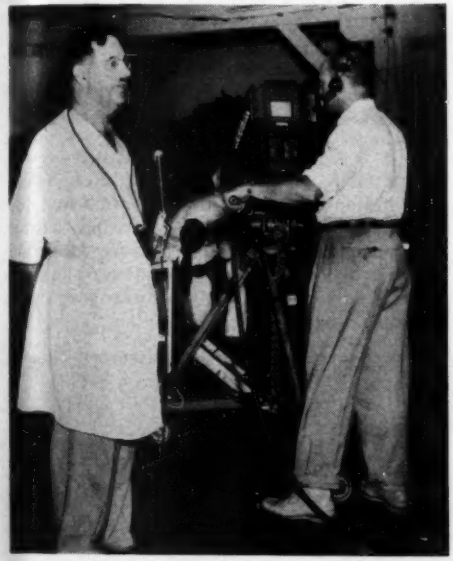
Those who participated in one or more of the televised sessions were amazed at the mass of equipment in the studio, and impressed by the efficient manner in which the programs were directed. Cameras on tripods and dollies, remote-controlled overhead cameras on specially constructed aluminum tracks, the monitor screen, control panels, wire and cable strewn on the floor and strung from support to support, presented a maze in the studio incomprehensible to the uninitiated. In all, 11,300 lb. of mobile television equipment were moved from Camden, N. J., to Toronto in 100 separate cases. Mr. Walter Lawrence of Radio Corporation of America estimated the total value of the equipment at $60,000. A team of seven television engineers was required to install and operate this complicated and delicate equipment. This experienced team has made similar installations in most of the major



General view of the studio as the first demonstration before the small animal section was introduced. (l. to r.) Dr. F. J. Kingma, Columbus, Ohio, narrator; cameraman; Dr. Frank Booth, Elkhart, Ind., assistant; and W. G. Magrane, Mishawaka, Ind., surgeon in the right background. Note three cameras, lighting equipment, and other essential paraphernalia.

cities of the United States, as well as in a number of foreign countries. Standard broadcast-type television cameras were employed at Toronto to feed signals to standard receivers located on all four sides of the meeting room.

A total of 54 veterinarians contributed to the six television sessions. Audio facilities made possible audience participation to the extent that questions were relayed promptly to demonstrators for answer. The accompanying illustrations are views behind the television screen, where only selected portions of the proceedings were transmitted as directed. Photographs were not posed, but were taken during the actual televising.



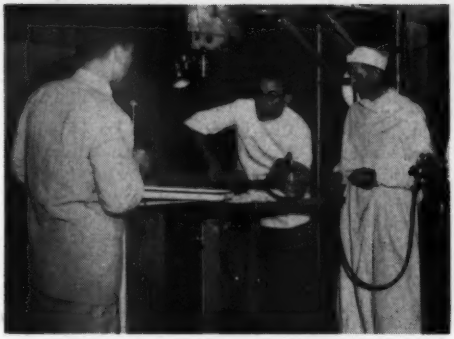
Technic of point firing by Dr. W. F. Riley, East Lansing, Mich. In the foreground (l.) Dean Chester F. Clark, East Lansing, Mich., narrator, and on the right, cameraman in action.

Scientific Program

Dr. R. A. Forsyth, Batavia, N. Y., told the convention that improvement of shipping conditions for sheep would materially reduce incidence of post-shipping complications. Overheating, chilling and irregularities in feeding and watering predispose to many diseases that may eventually sweep through a flock.

▼

Eimeria ninae-kihl-yakimovi has been found to be the causative agent of fatal ovine coccidiosis, reported Dr. John C. Lotze, BAI research scientist. Five species are known to cause



Demonstration of the Knowles thoracic surgery equipment. (l. to r.) Dr. F. J. Kingma, Columbus, Ohio, narrator; Dr. Jack O. Knowles, Miami, Fla., demonstrator; Dr. Alan Secord, Toronto, Ontario, assistant. Doctor Secord demonstrated earlier the Burns valve equipment used in his practice.

coccidiosis, but only one has been known to produce fatal results when injected in small quantities.

▼

Dried vaccine in a spray has been successfully used to protect poultry from Newcastle disease, reported Drs. S. B. Hitchner and G. Reising of the Massachusetts Experiment Station. Frozen vaccine, diluted with glycerine and atomized by compressed air, provided immunity to chickens. Spraying vaccine reduces cost of immunization by half.

▼

Dr. E. E. Ballantyne suggested three fields of research for controlling salmonellosis: (1) Egg disinfection, (2) hatchery fumigation, sanitation, and disinfection, and (3) better methods of detecting bacteria in flocks.

Dr. A. E. White, East Lansing, Mich., demonstrating a device (tail-sling) for restraining cattle.

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Bovine leptospirosis was reported to be so widely spread that control by regulation, regardless of rigid enforcement, would be practically impossible. The report of the Committee on Leptospirosis in Cattle and Swine suggested that control of this disease must be based on developing an immune cattle population. It was pointed out that leptospirosis can masquerade as one of a number of other entities, and that laboratory diagnosis is required to confirm an outbreak.

▼

A recent survey revealed that 70% of all poultry flocks in Canada are infected with infectious bronchitis. Spray vaccine also controls this disease, said Dr. J. F. Crawley, University of Toronto. The vaccine will protect poultry for at least 18 months.

▼

E. M. Dickinson reported that erysipelas bacterin conferred a measurable, but variable, degree of immunity in turkeys. A second dose of bacterin increases the degree of immunity.

▼

Anatipestifer infection was cited as the most important problem of commercial duck raisers. The disease has attacked every duck farm on Long Island, taking a mortality toll as high as 75%.

Experiments have indicated that prolonged dosage levels of antibiotics produce undesired effects. Dr. J. D. Nadeau, St. Hyacinthe, Que., reported that feeding of antibiotics may interfere with natural immunity of chickens to infectious diseases.

▼

Drs. C. E. Rice and Paul Boulanger reported that early diagnosis of foot-and-mouth disease and vesicular stomatitis can be made in most cases by complement-fixation tests. In the Canadian outbreak, tests enabled veterinarians to determine the type of virus involved.

▼

Brucellosis was termed the most costly cattle disease. The Committee on Brucellosis recommended legislation, educational campaigns, and elimination of reactors, as prime control features. They also called attention to the 44% reduction in personnel fighting the disease.

▼

Drs. G. K. L. Underbjerg and M. J. Swenson, of Kansas State College, reported that the value of adding trace minerals to cattle rations is a controversial question because most authorities believe feeds grown on most normal soils supply sufficient quantities of these minerals.

General view of audience in the Concert Hall. Note screens placed at frequent intervals around the large room.

Veterinary Director General of the Canadian Department of Agriculture, Dr. T. Childs, said that strict controls on garbage feeding have helped limit trichinosis in Canada.

▼

Dr. R. S. Sugg of the School of Veterinary Medicine, Alabama Polytechnic Institute, Auburn, outlined a six-point program to eradicate hog cholera. This program included: (1) Discontinuance of the use of live virus, (2) rigid isolation and 30-day quarantine of herd additions, (3) burning carcasses of all dead hogs, (4) feeding only sterilized garbage, (5) maintaining sanitary farrowing lots, and (6) preventing contact with hogs from other farms.

▼

Dr. Orlan Hall of Canada stated that cost under a slaughter and indemnity plan for control of hog cholera averages $20,000. annually in Canada. This figure is less than cost of control by vaccination in many single counties of the United States.

▼

Atrophic rhinitis is wide-spread. While this disease causes a relatively small death toll, economic losses are considerable, according to the report of the Committee on Infectious Atrophic Rhinitis. The third year a herd is infected is an especially nonproductive period. By the fourth year, the owner is out of business.

▼

Dr. H. G. Lamont of North Ireland described a swine disease which produces staggering, hiccuping pigs. Known as edema disease, it as a great threat to Irish swine populations. Typical symptoms include swelling of eyelids, ears, face, and other parts of the body. Staggering gait and partial paralysis may mark later stages. Magnesium sulfate has been used to control spread of the infection.

▼

Dr. George Young, of the Hormel Institute, outlined a technic whereby it is possible to obtain pigs free of parasites, bacteria, and viruses. Young pigs were taken from sows by surgical methods, and raised in brooders for several weeks. Then, they were fed to market weights under practical farm isolation.

▼

Dr. L. M. Hutchings and Dr. L. P. Doyle of Purdue University credited most of modern swine raiser's losses due to intestinal problems to one of three swine diseases: cholera, swine dysentery, and transmissable gastroenteritis.

▼

Dr. L. C. Swan of St. Catharines, Ont., stated that: "A well-rounded sanitary program can best control swine enteritis, with antibiotics and other new drugs used to combat outbreaks if they occur."

■

Use of new antibiotics to control disease problems in dairy herds sometimes presents a human health problem. Milk from treated cows can create an antibiotic sensitivity in persons consuming either raw or pasteurized milk. The Public Health Committee recommended that dairy herd owners and livestock raisers should be informed of the dangers inherent in lay medication.

Dr. James L. Palotay, Greeley, Colo., veterinarian of the Montfort Feeding Station, said that antibiotics apparently help prevent outbreaks of shipping fever if administered three to five days after cattle arrived on the feedlot.

▼

Drs. Homer E. Dale and Samuel Brody reported findings indicating that hot weather and bright light can lower milk production of dairy cows and alter blood constituents. Working in the Psychroenergetic Laboratory at the University of Missouri, these scientists found that milk production is inversely proportional to environmental temperature.

▼

Failure to provide proper care for sheep during long shipments lowers resistance and opens the way for shipping fever, paratyphoid dysentery, and coccidiosis. — *R. A. Forsyth, D.V.M., Batavia, N. Y.*

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Women's Activities

More than 1,000 women attended the annual luncheon at Exhibitor's Park. Afterwards, Mr. Davies of Copeland and Duncan Ltd. discussed spode china.

Mrs. J. D. Grossman (Ohio), Mrs. G. G. Graham (Mo.), and Mrs. C. D. Folse (Tex.), were introduced to the group. Several past-presidents, representatives of several student auxiliaries, and Mrs. A. E. Bott, president of the International Auxiliary and American Mother of the Year, were also presented. At the House of Representatives meeting of the auxiliary, all charter members were voted life members.

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Awards

A feature of the opening session was the presentation of the following awards: the XII. International Veterinary Congress Prize, the Borden Award for 1953, the annual A.V.M.A. Award, and the Humane Act Award.

International Veterinary Congress Prize

The XII. International Veterinary Congress Prize was awarded to Dr. Leunis Van Es, Lincoln, Nebr., in recognition of his outstanding

Dr. Leunis Van Es

service to veterinary science and the profession. This award, consisting of a certificate and a cash prize, was established in 1936, and represents the highest honor bestowed by the A.V.M.A. on one of its members. Doctor Van Es is the 17th recipient.

Born in Holland, Doctor Van Es graduated from the Ontario Veterinary College in 1893; he later studied medicine and received his M.D. degree from the University of Alabama. He was head of the Department of Veterinary Science at North Dakota Agricultural College for 15 years, and chairman of the Department of Animal Pathology and Hygiene at the University of Nebraska from 1918 until his retirement to emeritus status in 1946.

Doctor Van Es has contributed over 100 scientific articles to veterinary literature, and is the author of The Principles of Animal Hygiene and Preventive Veterinary Medicine. He is past vice-president of the A.V.M.A.

The citation commended Doctor Van Es for his pioneer research on swamp fever of horses, avian tuberculosis, "walking disease" of horses and cattle, and for investigation of many other livestock disease problems.

Borden Award

Dr. George H. Hart, dean, School of Veterinary Medicine, University of California, Davis, received the Borden Award and medal, sponsored by the A.V.M.A. to recognize and en-

Dr. George H. Hart

courage research in animal diseases and related sciences. The citation commended Doctor Hart on original research on contagious diseases and nutritional problems of dairy cattle, and for studies on tuberculin testing,

Dr. George W. Gillie

carrier and immunity problems in brucellosis, and vitamin deficiency disease. On all of these matters Doctor Hart reported in scientific journals, which reports constituted the basis for the award.

Doctor Hart was awarded the XII. International Veterinary Congress Prize in 1938.

A.V.M.A. Award

Dr. George W. Gillie, Fort Wayne, Ind., was

selected as the fifth veterinarian to be awarded the A.V.M.A. award. The presentation was made in Toronto, where Doctor Gillie was cited for distinguished service to livestock health in America, and for his staunch support of legislation needed for effective control of livestock diseases.

Doctor Gillie served four terms in the U. S. House of Representatives from 1937 to 1945. In his legislative work he had a deep interest in the personnel needs of the Bureau of Animal Industry, and was most helpful during World War II on matters concerning the military status of veterinarians and veterinary students.

Martin Nicholson, with the dog he rescued

Humane Act Award

The youth of America were again honored by selection of a boy who had performed an outstanding act of kindness to animals. Winner of the 1953 Humane Act Award was 14-year-old Martin Nicholson, Lynn Valley, British Columbia, Canada. The youth was given the honor on recommendation of the Awards Committee. Martin, with complete disregard for personal safety, risked his life to rescue a dog stranded on a narrow ledge above boiling rapids.

Seattle, Washington in 1954

Host city for the 91st annual convention of the A.V.M.A., to be held during the summer of 1954, will be Seattle, Wash. Minneapolis, Minn., was selected as the convention site for 1955 at the meeting last year, and San Antonio received the nod of the House of Representatives for 1956. The latter meeting is planned for the late summer or fall season.

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Educational Exhibits

Fifteen well-designed educational exhibits were displayed on the mezzanine of the convention floor of the Royal York Hotel, convention headquarters. All of these, prepared by organizations or groups, attracted favorable attention.

Following the custom of previous years, awards were made for the three exhibits having the most educational value. First and second awards were conferred on two exhibits prepared in Canada. First prize went to Practical Plastic Prosthesis for Femoral Heads, an exhibit which was designed by the Departments of Anatomy and Small Animal Medicine of the Ontario Veterinary College; the second place award was given to an exhibit on Rabies Control in Wildlife in Alberta. Dr. James Archibald, Guelph, Ontario, and Dr. John Ballantyne, Edmonton, Alberta, cosponsored the winning exhibit; Doctor Ballantyne was the second-place winner. Third place winner, Radiology in Veterinary Medicine, was presented by Drs. T. J. Hage, G. H. Hart, and H. S. Cameron, of the School of Veterinary Medicine, University of California, Davis.

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Foot-and-Mouth Disease

(Continued from page 354)

remain under a rigidly enforced quarantine. Susceptible animals within a buffer zone, approximately 15 miles around the quarantine zone, may not be moved except under permit. Daily inspections will be made until Commission veterinarians are certain there is no longer any danger of spread of disease. Animals within an area of about six to nine miles around the zone where infection is known to exist will be vaccinated by Commission employees.

There is no doubt that the situation in Mexico is grave. The cattle industry of the entire continent is threatened unless cooperative efforts result in prompt and effective control of the disease. Perhaps the vivid contrasts which unquestionably exist in this situation and affect the problem justify a reappraisal of past control measures and their real value in the development of an acceptable, though perhaps unconventional, approach to meet the exigencies of the present outbreak.

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Pens containing hogs affected with atrophic rhinitis are apparently safe to use again after 21 days.—*F. W. Schofield, D.V.M., D.V.Sc., D.M.V., and A. Robertson, D.V.M., Guelph, Ont.*

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PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Bovine Leukemia

A veterinary correspondent wrote us that he has diagnosed leukemia in a four-year-old Hereford bull. The owner of the bull would like to use him as a sire for a period of several months. The question raised, would there be any danger to the cows bred to this bull or to the offspring? Since the cause of leukemia is obscure, there certainly is no evidence that there is contagion or a hereditary factor. Our correspondent was informed that so long as the animal continued in good flesh and had a normal appetite, we were aware of no reason why this bull should not be used for breeding purposes.

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Scrapie of sheep, according to press releases, has been diagnosed recently in Ohio and Illinois. Last fall it was in Butte County, California. The disease is a chronic, slowly developing neurosis of sheep, characterized by pruritus of the skin so that wool is rubbed out. Other symptoms include unsteady gait, nervous fear, decubitus, and death.

The exact cause is not known though by means of inoculations of emulsions of nervous tissue from affected animals it has been transmitted. If veterinarians suspect the presence of this disease, they should notify state or federal veterinary officers to make an investigation and, if diagnosis is substantiated, quarantine will be applied. Destruction of affected and exposed sheep and the sanitary disposal of carcasses are recommended control measures.

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Steers on full supplemental feed gained about ½ lb. per day over untreated steers when the treated ones had implanted under the skin of an ear five pellets (poultry variety) of stilbestrol. Each pellet contained the usual poultry dose of 12 mg. In heifers there is said to be danger of vaginal prolapse and, therefore, only steers were treated. The ear was used for implantation purposes because it is usually discarded at the time of slaughter. The test was on 500 animals for from 64 to 181 days. This method of treatment does not at this time have the approval of the U. S. Pure Food and Drug Administration.

Heard at a recent veterinary conference:

1. Lesions of enterotoxemia in sheep develop slowly. The characteristic pulpy kidney lesion is observed clearly a few hours after death.

2. Enterotoxemia antitoxin is highly effective as a prophylactic. The resistance it confers is of short duration and, therefore, after an interval of approximately three weeks, enterotoxemia bacterin should be administered. This bacterin is actually a toxoid and should be kept under refrigeration.

3. Urethral calculi are observed frequently in those flocks having access only to filthy water. Sheep do not like dirty water and, therefore, drink only a small amount of it. Limited intake is an important factor in formation of calculi.

4. The fringed tapeworm may obstruct the excretory duct of the liver, and thus cause death.

5. Antihistamine is of value in treatment of sheep affected with "big head."

6. During two successive early spring seasons, breeding ewes were given free access to succulent green wheat pasture. This is referred to by sheep growers as "flushing". These ewes were also treated with stilbestrol to induce estrum. Results were excellent and a good crop of early lambs—the so-called "hot-house lambs"—were raised. The third spring, ewes were again treated. Because of the season no wheat pasture was available and there could be no flushing. Practically no response to use of the hormone was reported. The opinion was expressed that flushing was more important in producing an early lamb crop than use of the hormone.

7. One of the best means of controlling hemorrhagic enteritis, actually a colitis, is to keep moving clinically healthy pigs to new clean areas as rapidly as the condition appears in a drove.

8. When swine "go off", start at once to determine whether the condition is hog cholera or acute swine erysipelas. If differential diagnosis is questionable, administer hog cholera antiserum. This serum, probably because it may have been derived from erysipelas immune hogs, has, in many instances, virtue for both ailments.

Toxoplasma Observed in a Rabies Suspect*

ALICE KIMBALL, B.S., and M. J. TWIEHAUS, D.V.M., M.S., Manhattan, Kansas

A dog's head was sent from the southern part of the state to the pathology laboratory for rabies examination. Direct smears prepared from the hippocampus major (Ammon's horn) revealed absence of Negri bodies within the large neurons. However, since many inclusion-like bodies were found in the cytoplasm of the neuroglia cells, canine distemper was suspected. To aid in correct diagnosis, sections were prepared from Zenker's-fixed Ammon's horn and the underlying thalamus. Sections were stained by the following six methods: Shorr's (S3); phloxine and methylene blue; Schleifstein's; hematoxylin and eosin; Wright's (modified); and Seller's rabies stain.

Microscopic Findings

Examination with low power (100x) and high dry (440x) magnification revealed in all slides a circular area of degeneration in the center of the hippocampus major, measuring approximately 2.5 mm. in diameter. This area showed complete disorganization of tissue and destruction of many nerve cells.

Oil-immersion (950x) examination revealed presence of many protozoon-like parasites within the area of degeneration and in closely surrounding tissue. Although the majority of these parasites appeared round, averaging about 2 microns in diameter, a few elongated forms were observed which measured approximately 3 microns in length. They occurred in aggregates as well as lying free or within host cells, and were noticeably more concentrated around blood vessels. They were also found frequently within neurons (fig. 1A and 2).

Cyst-like aggregations of the parasite were quite plainly visible with high dry magnification after one became aware of their presence. Although different staining characteristics and color combinations resulted from various staining technics, the organisms were easily demonstrated by all staining methods employed.

After much study of prepared slides, and also the literature,[1,2,3,4,5,6] identification of the parasite still was uncertain; and so slides were sent to Dr. T. S. Perrin of the National Institute of Health, who definitely identified the organism as Toxoplasma.

Fig. 1-A. Toxoplasma within large neurons. -B. Cytoplasmic changes in neuroglia cells giving appearance of inclusion bodies. Magnification approximately 1800X.

Animal Inoculations

In order to rule out the possibility of rabies, two hamsters and two young guinea pigs were inoculated intracerebrally with brain material which had been preserved in 50% buffered glycerin for 48 hours. The animals were held 90 days before being destroyed and no symptoms of rabies were exhibited. It is interesting to note that hamsters and guinea pigs are both susceptible to the Toxoplasma parasite; however, since 50% buffered glycerin is not a preservative for Toxoplasma, the parasites probably were destroyed, thus accounting for the inoculated animals not contracting the disease.

Discussion

Clinical history of this dog would have been interesting, but the head was received with a request for a rabies examination, and under the circumstances it was impossible to obtain

*Contribution no. 116, Department of Veterinary Medicine, Kansas State College, Manhattan.

any clinical information. However, it seems likely that the dog might have shown nervous symptoms, due to the area of complete tissue destruction found in the hippocampus major.

Toxoplasma seems to be confused more often with Encephalitozoon than any other parasite, and in some species both organisms show strong predilection for nerve tissue. Confusion has been greatly clarified, however, by Perrin[5] in his comparative study of the two parasites.

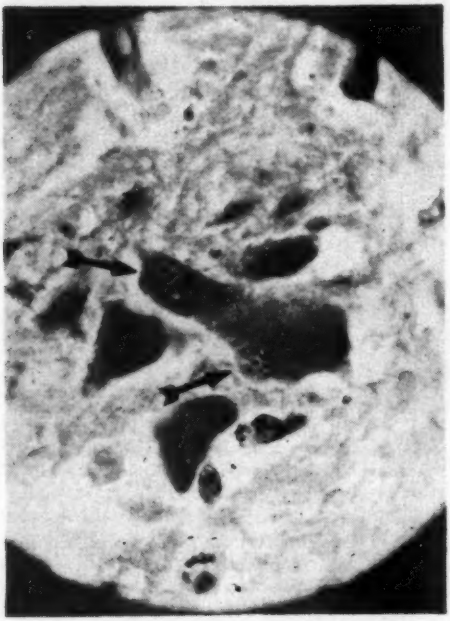

Fig. 2. Two aggregates of Toxoplasma within a neuron. Magnification approximately 1800X.

Neuroglia cells, as they appeared in prepared sections, were somewhat modified from their appearance in smear preparations. Nevertheless, inclusion-like bodies were still present and very well delineated by Schleifstein's staining method (fig. 1B). It has been suggested that these structures are probably alterative changes in the cytoplasm, perhaps degenerative in type. No apparent lesions or Toxoplasma parasites were observed in the thalamus.

Summary

By means of tissue sections Toxoplasma was discovered in the brain of a dog suspected of suffering from rabies. Parasites were not observed in direct smears prepared for rabies examination. Histologically, Toxoplasma may be confused with the Encephalitozoon parasite.

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Recovery of *Brucella bronchiseptica* from a Chinchilla

W. T. SHALKOP, D.V.M., Washington, D.C.

Brucella bronchiseptica has been reported in rodents such as the rabbit, guinea pig, and rat, as well as in the dog, cat, ferret, goat, pig, monkey, and man. This wide host range would suggest that the chinchilla may not be an unnatural host to this organism, but to our knowledge recovery from the chinchilla has not previously been reported.

A local chinchilla rancher reported losing an adult male that exhibited marked respiratory distress throughout its illness. This animal was not available for laboratory examination. A few days after the death of the male, an adult female penmate developed the same respiratory symptoms and, after death, was brought to this laboratory. On postmortem examination the liver was noted to be enlarged, there was impaction of the cecum, lobes of the left lung were hemorrhagic and edematous, and the right lung appeared emphysematous. This animal was sick approximately four days. Initial symptoms were mucous discharge from the nostrils and labored breathing. Later, this animal had difficulty in maintaining its balance while walking. Approximately 1,000,000 units of penicillin were administered intramuscularly before death.

Bacteriologic cultures were made of the brain, liver, heart blood, and lung. A pure culture was obtained from the brain and lung. It required 48 hours to develop noticeable growth on serum agar and the colonies were small, white, slightly raised, and entire. Organisms were motile, some showing a tumbling type of motility, and morphologically and biochemically were similar to *Brucella bronchiseptica*.

A 48-hour broth culture was injected subcutaneously into two adult rats, intraperitoneally into one adult guinea pig, and subcutaneously into another adult guinea pig. These remained apparently normal.

Four days later the same rancher brought in a one-month-old chinchilla that was the offspring of the previous two mentioned in this report. This animal had also shown respiratory distress and was sick about two days before it died.

A pure culture, similar in all characteristics to the one recovered from the dam, was obtained from the brain and lung of the young chinchilla. A 48-hour broth culture was injected intraperitoneally into two 325 gm. guinea pigs. Both of these laboratory animals were dead within 48 hours, and the lungs of both animals were hyperemic and edematous. A pure culture of the same type of organism injected two days previously was recovered from the lungs of the guinea pigs on bacteriologic examination.

Histologic sections of the lungs of both the adult female and the baby chinchillas showed marked bronchopneumonia, and organisms morphologically similar to the ones isolated on bacteriologic culture were present within the affected areas. The lungs of the guinea pigs revealed congestion, edema, slight atelectasis, and the alveoli of the apical lobes were infiltrated by large macrophages. Organisms isomorphic with those injected were seen within the macrophages. Brain sections of both the female adult chinchilla and the offspring were negative for any significant pathologic changes.

The organism recovered from the chinchillas is believed to be *Brucella bronchiseptica* for the following reasons:

It was recovered from pneumonic lung lesions in the chinchillas.

Its morphologic, biochemical, and colonial characteristics were similar to *Brucella bronchiseptica.*

It was pathogenic for young guinea pigs and was recovered from affected lung tissue after intraperitoneal injection into these animals.

On the basis of the pathologic alterations in the lungs of the chinchillas and the histologic demonstration of the organism in tissue sections and subsequent recovery on bacteriologic examination, it is evident that *Brucella bronchiseptica* is pathogenic for the chinchilla. Whether this occurs as a primary or secondary invader could not be determined from laboratory studies; there was no evidence of a primary invader.

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Radical Amputation of Scapula and Limb*

FRANK A. HAYES, A.B., B.Sc., D.V.M., and NANCY S. DORSEY, D.V.M.

Aberrant fractures in the limbs of Canidae present a challenge in methods of surgical correction. Necrosis of tissue combined with invasion by saprophytic organisms adds to the complexity of the problem, amputation usually being an exigency. The case reported is one in which the entire foreleg and shoulder were involved. Generalized septicemia had been precipitated and further attempts to save the appendage were deemed hazardous.

History. On the night of May 17, 1953, a two-year-old male, Staffordshire Terrier was presented for treatment of a large, open, gunshot wound of the right shoulder and limb. The wound had been inflicted the previous day. The animal was semicomatose and in a state of severe shock. Temperature was 98.6 F.

Observations and Therapeusis. Immediate therapy consisted of the administration of 750 cc. whole blood and 300,000 units of penicillin. On the following morning an *x*-ray revealed the entire limb to be loaded with small shot, the main mass located in the mid-scapular region. A compound, comminuted fracture of the distal end of the scapula was demonstrated with disarticulation of the humeroscapular joint. An attempt was made to save the limb. The following chart indicates progress and treatment.

The animal's condition was becoming progressively worse and decision was made to amputate the limb, scapula included.

Pre-operative Care. Food was withheld for 12 hours prior to surgery. One-half gr. morphine plus 1/150 gr. atropine was administered subcutaneously as a preanesthetic. Five hundred cc. of whole blood were given prior to general anesthesia. Pentobarbital sodium was employed for general anesthesia and administered to effect throughout the operation. The animal was placed in a lateral recumbency and a large area prepared and draped. Sterile stockinet was used to cover the limb to reduce possibility of contamination. Continuous drip of blood was started prior to the initial incision and continued throughout the operation.

*Surgery under supervision of Department of Clinics and Medicine, University of Georgia, Athens. The authors acknowledge the assistance of Joseph Johnson, Roy Smith, Bruce Riggs, Wayland Andrews, and John Whittaker.

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CHART 1. Progress and Treatment

Date	Progress	Treatment
May 18, 1953	Temperature: 102.8 F. Condition: Poor	300,000 units penicillin
May 19, 1953	Temperature: 102.1 F. Erythrocyte Count: 4,920,000 Hemoglobin: 8 gm. %	1000 cc. whole blood
May 20, 1953	Temperature: 102 F.	5 cc. liver extract 300,000 units penicillin Combiotic® ointment to lesion
May 21, 1953	Temperature: 102.1 F. Condition: Unfavorable Erythrocyte Count: 4,450,000	Wound debrided VCBU† ointment in pack 350 cc. whole blood
May 22, 1953	Temperature: 102.3 F.	

Surgical Procedure. Starting 3 cm. dorsal to the scapula, an eliptical incision was made anteriorly to the scapula to a point 5-7 cm. dorsal to the sternum, continuing posteriorly to the scapula until point of origin was reached. Skin was dissected away from the shoulder, reflected, and retracted until completion of the removal of the limb. Medial dissection was accomplished by blunt and sharp manipulation. Minor hemostasis was achieved with hemostats and 00 catgut ligatures. Larger arteries were transfixed with no. 35 stainless steel wire, this transfixion being accomplished by utilization of all available fascia. Rhomboideus muscles were dissected free and the limb removed. Skin flaps were trimmed for adequate adherance to the body wall and subcutaneous fascia sutured to fascia of the intercostal muscles. Through the entire surgical process, pulse rates were taken at two-minute intervals. On five occasions, when the rate exceeded 200 per minute, all surgical maneuvers were discontinued, the operative site covered with sterile gauze and moistened with physiological saline[1]. Upon approach of normal pulse rate, the surgery was continued. Penicillin-impregnated gauze was placed in the wound and the skin edges approximated with no. 35 stainless steel wire. The animal was transferred to the surgery ward and body heat conserved for the duration of anesthesia by means of added cover.

Three hundred thousand units of penicillin and 0.5 gm. of streptomycin were administered intramuscularly at the time of removal to the surgery ward. The animal received a total of 2,500 cc. of whole blood by continuous drip throughout surgery.

Post-operative Care. Eighteen hours after surgery, the animal was standing, and eating normally. No secondary complications were observed. The gauze pack was removed 48 hours following surgery and penicillin and streptomycin therapy was continued for an equal length of time. Recovery was uneventful. At present the animal maneuvers well and adipose tissue is filling in the cavity.

Conclusion. In severe trauma of the scapula and foreleg, radical removal of these parts is both practical and indicated. If adequate attention is given to supplying blood during surgery and preventing surgical shock by constant pulse rate check during the operation, cases of this nature have greatly increased opportunity for survival during and after surgery.

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American resourcefulness has been applied in the full utilization of mink pelts. The central back portion of each pelt is used in the larger garments; the head, leg, tail, and flank portions in numerous accessories. Individual hairs are used in artists' brushes.—*Am. Fur Breeder*, 26:7 (May), 1953.

®Chas. Pfizer & Co., Inc., Brooklyn, N. Y.
†Warren-Teed Products Co., Columbus, Ohio.